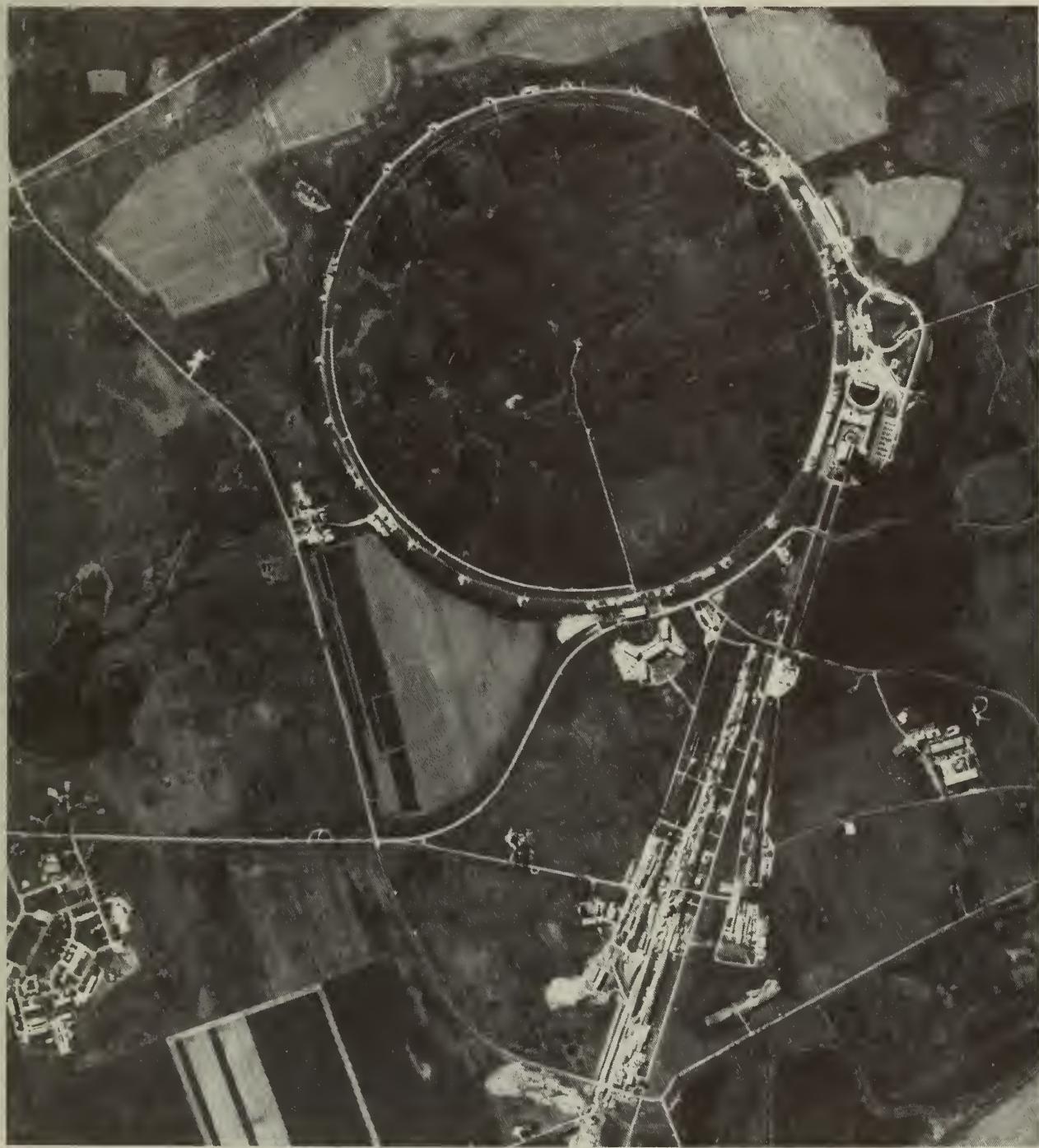


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BATAVIA AREA

Geological Science Field Trip

David L. Reinertsen



Field Trip, 1986C October 4, 1986
Department of Energy and Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
Champaign, IL 61820

A GUIDE TO THE GEOLOGY OF THE BATAVIA AREA

David L. Reinertsen

BATAVIA GEOLOGICAL SCIENCE FIELD TRIP

AN OVERVIEW

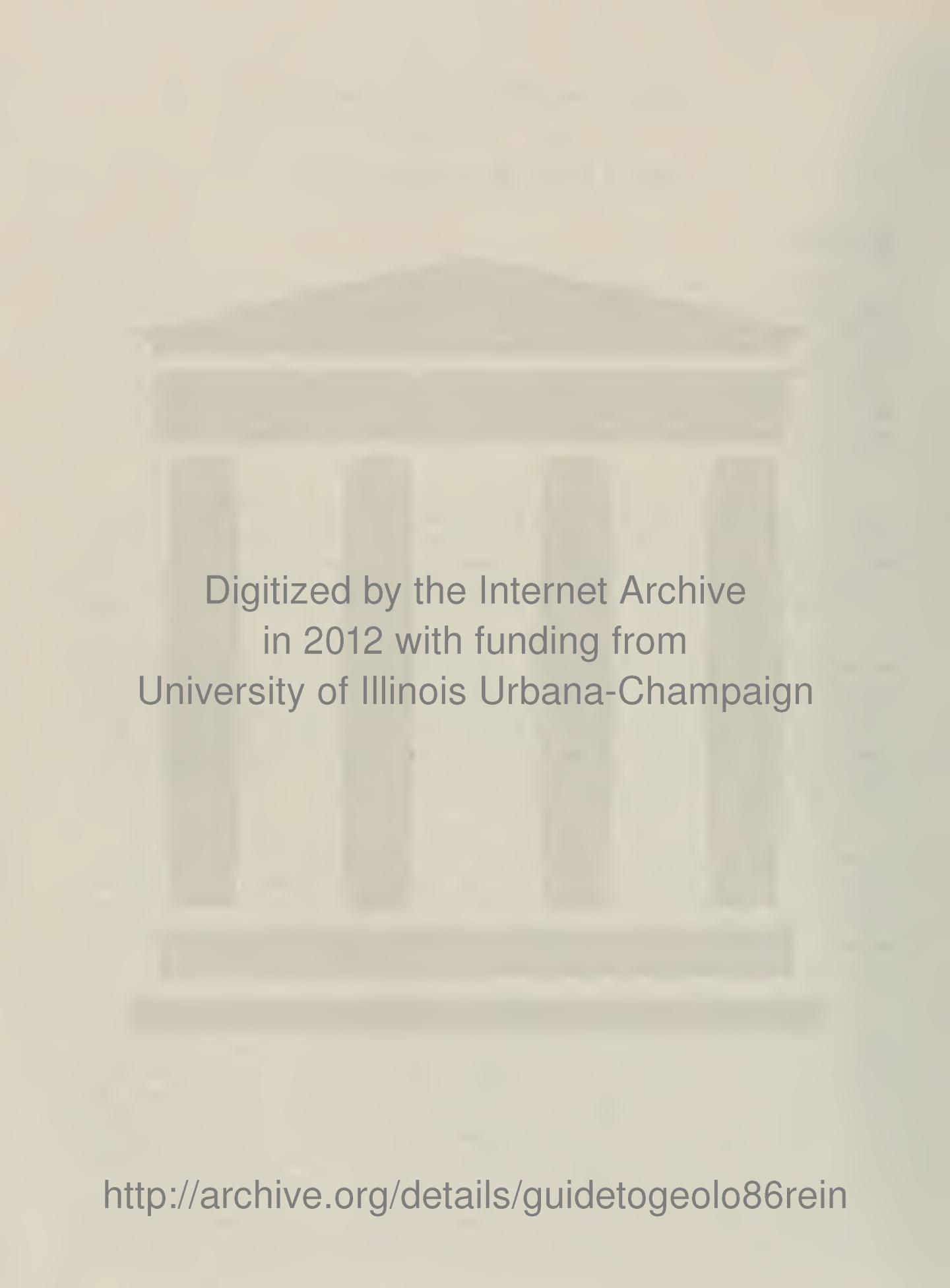
The Batavia Geological Science Field Trip will acquaint you with some aspects of the general geology, surface topography, and mineral resources along a portion of the western side of the Chicago Metropolitan Area, home to more than 7,000,000 people. The information in this guide leaflet, in addition to your personal observations along the itinerary, will show you how geology relates to regional land-use planning and urban environmental improvement, to construction problems (structure foundations, highways, tunnels, etc.), and to locating, developing, and conserving our mineral and water resources.

The geographic location and geologic setting of the Chicago region strongly influenced its growth and development from the early 1800s. Cheap water transportation, via the Great Lakes and the Illinois Waterway, and the availability of mineral and water resources, led to the region's early rise to importance. A short time later, a number of railroads converged on the city to strengthen further its national and international importance and influence.

The rapidly expanding populace of the Chicago Metropolitan Area has not adjusted easily to its environment. Although many land-use problems have been resolved, others, such as the interrelationships between land burial and disposal of wastes and urban sprawl, the mineral and groundwater resources of the area, have not been understood. Recognition of the problems and awareness of some of their possible solutions will help the citizens of the Chicago region make intelligent use of the important natural assets that make the Chicago region an especially desirable place to live and work.

This field trip area is located in the west-central part of Du Page County and the southeastern part of Kane County. Here the scenic valley of the Fox River provides ideal locations for residential communities within an easy 35-mile commuting distance from Chicago's Loop. The gently undulating to rolling topography studded with groves of trees and scattered peat bogs is densely populated east of the Fox River, but is given over almost entirely to row crop agriculture west of the river.

The 1980 census lists a population of 658,177 for Du Page County, and 278,405 for Kane County. The counties populations have not always been so large. Before World War II, these western communities were comparatively small and scattered across a predominantly rural landscape. The larger population centers, however, were located along the railroads, U.S. highways, and major state routes. Although some manufacturing was carried out in the larger towns and cities because of good transportation facilities and cheap water and electric power supplies, much of the region was devoted to farming, including much truck farming that raised a significant amount of the fresh produce needed by the city a short distance to the east. Some wealthy families from the city maintained large permanent country estates here and commuted to their businesses, while others had summer retreats, especially along the Fox River.

A faint, light-colored watermark or background image of a classical building with four prominent columns is visible across the entire page.

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The more affluent of Chicago's exploding post-war populace fled to the suburbs--a trend that continues today. Rapidly burgeoning suburbs have had a difficult time trying to provide the essential municipal and public services that their new residents have demanded. To further complicate the situation, as new and better highways radiated outward from the city, more light industry, commercial firms, and research facilities have also moved to the suburbs. In many cases, the old "bedroom communities" are no longer that--they now have enough jobs to support a good portion of their population.

Du Page County now contains at least 33 incorporated cities and villages that lie wholly or partly within its boundaries. These communities are rapidly expanding and extending their boundaries up against their neighbors. It won't be long before the whole county is urbanized--farmland is fast being overridden by industrial complexes, shopping malls, and subdivisions. Kane County just to the west now has at least 22 incorporated cities and villages within its borders. Here, as noted earlier, the population is not so dense, except for a north-south alignment of industrial, commercial, and residential communities concentrated along the Fox River. The Fox has tended to slow the westward expansion of urbanization both because of the development along its valley and partly because the commuter railroads terminate at the valley towns. As the greatest part of its farmland lies west of the Fox, Kane County has endeavored to curtail westward sprawl of subdivisions to within about 5 miles of the Fox, about the location of Randall Road, which the fieldtrip route crosses. However, you will note that there are now some very new subdivisions west of Randall Road.

Realizing that the economic and natural assets of the Chicago Metropolitan Area would be severely stressed by uncontrolled growth and urban sprawl, local governments formed the Northeastern Illinois Planning Commission (NIPC) in order to develop a regional view of the problems facing the communities. The State Geological Survey was enlisted to help in this effort. The Survey generated and compiled a considerable amount of data, much of it displayed on maps and in reports to NIPC issued during the late 1970s. Such information on the soils, rock materials, ground-water, and surface waters contributes to an awareness of the natural assets of the region and to an understanding of environmental limitations and problems. Development based on such an awareness can enhance and protect the physical environment rather than cause its deterioration.

Geologically, the Batavia area in northeastern Illinois has undergone many changes throughout millions of years of geologic time. Igneous and possibly metamorphic rocks compose the ancient Precambrian basement that lies deeply buried beneath some 3,000 to 3,300 feet of younger sedimentary rock strata that were deposited in shallow seas that repeatedly covered this part of our continent. Most of these sedimentary bedrock strata are Paleozoic formations ranging in age from Cambrian through Silurian (from about 570 to nearly 375 million years old) (figs. 1 & 2). Younger Paleozoic bedrock strata, which are known from outcrops just a few miles away from the field trip area, covered this area at one time. Then, during the 245 million years between the close of the Paleozoic Era and before the Pleistocene glaciers advanced into Illinois, 1 to 2 million years ago, an unknown (but probably not very large) thickness of these strata was eroded away.

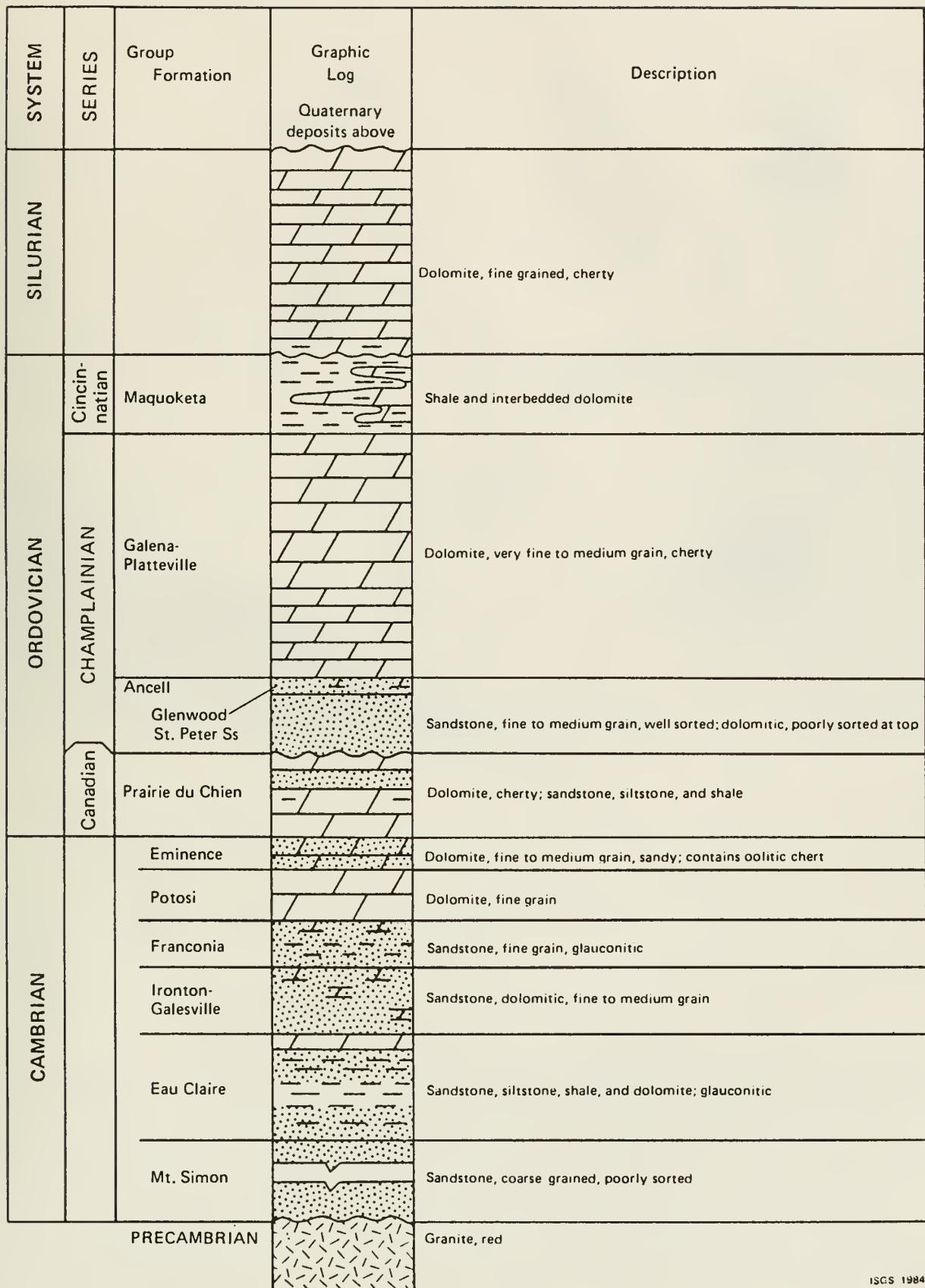


Figure 1.
Stratigraphic column of bedrock units in northern Illinois. From Kempton et al., 1985.

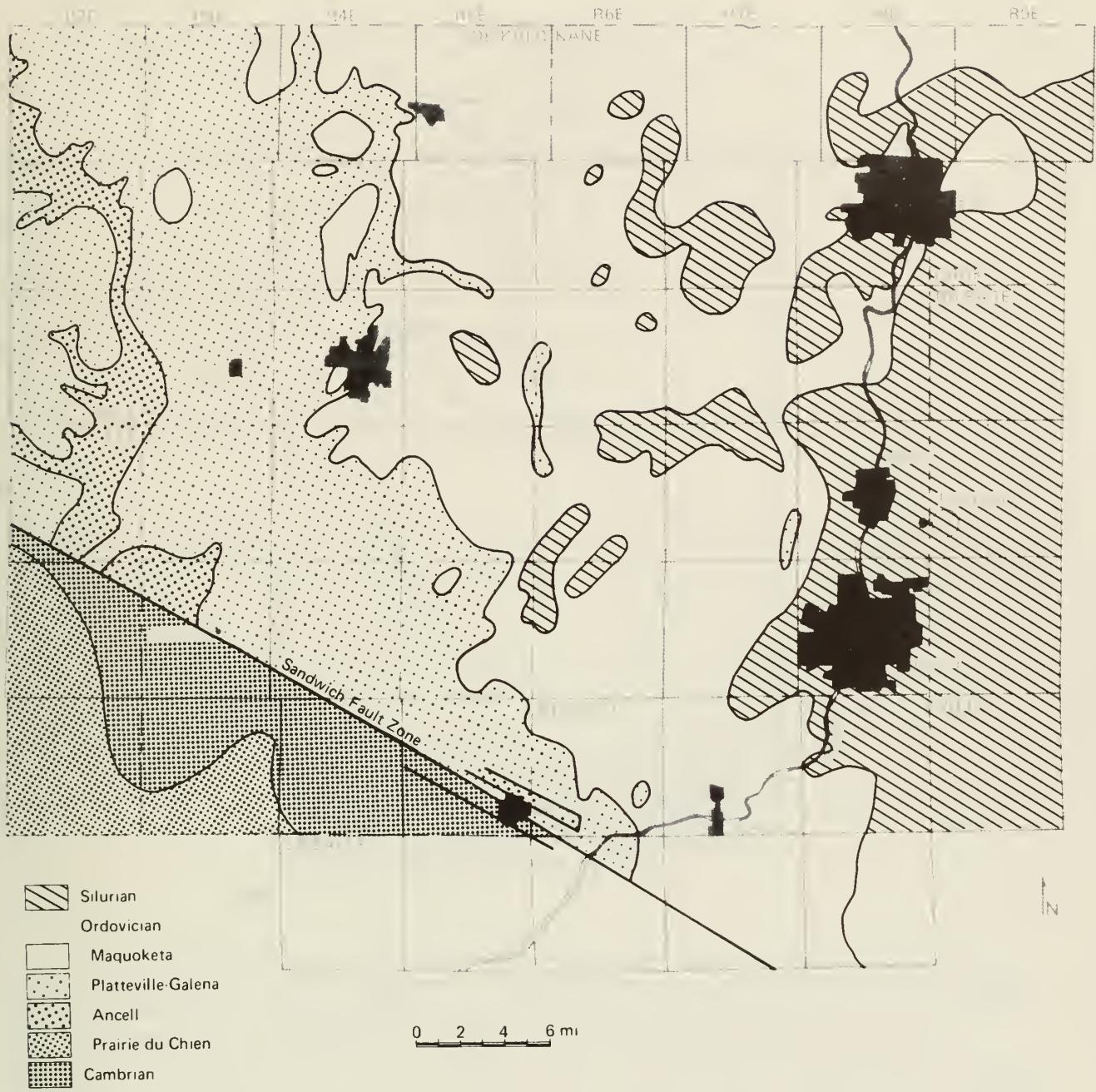


Figure 2.
Areal geology of the bedrock surface in study area. From Kempton et al., 1985.

Paleozoic bedrock strata in the Chicago area are not really flat lying or "layer cake" in their attitude. Instead they are gently warped up across the Kankakee Arch, a broad, northwest- to southeast-trending structural arch that connects the Wisconsin and Cincinnati Arches (fig. 3). The Kankakee Arch separates two broad structural basins--the Illinois Basin to the southwest and the Michigan Basin to the northeast. The field trip area lies close to the crest of the Kankakee Arch. The bedrock strata here are tilted very slightly toward the south-southwest into the Illinois Basin. Locally there are exceptions to these gentle dips. Tilting of the bedrock strata took place several times during the geologic past with the result that the bedrock strata are not parallel to each other.

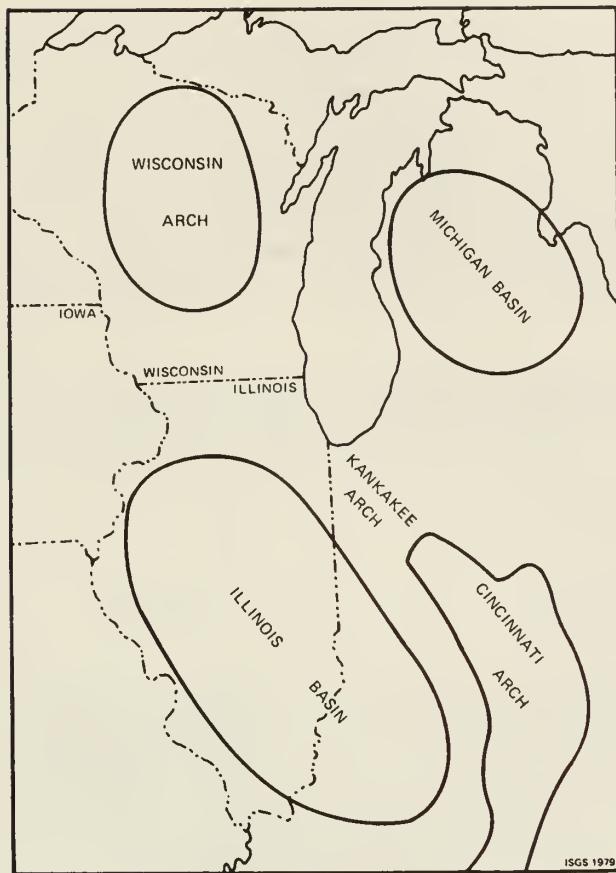
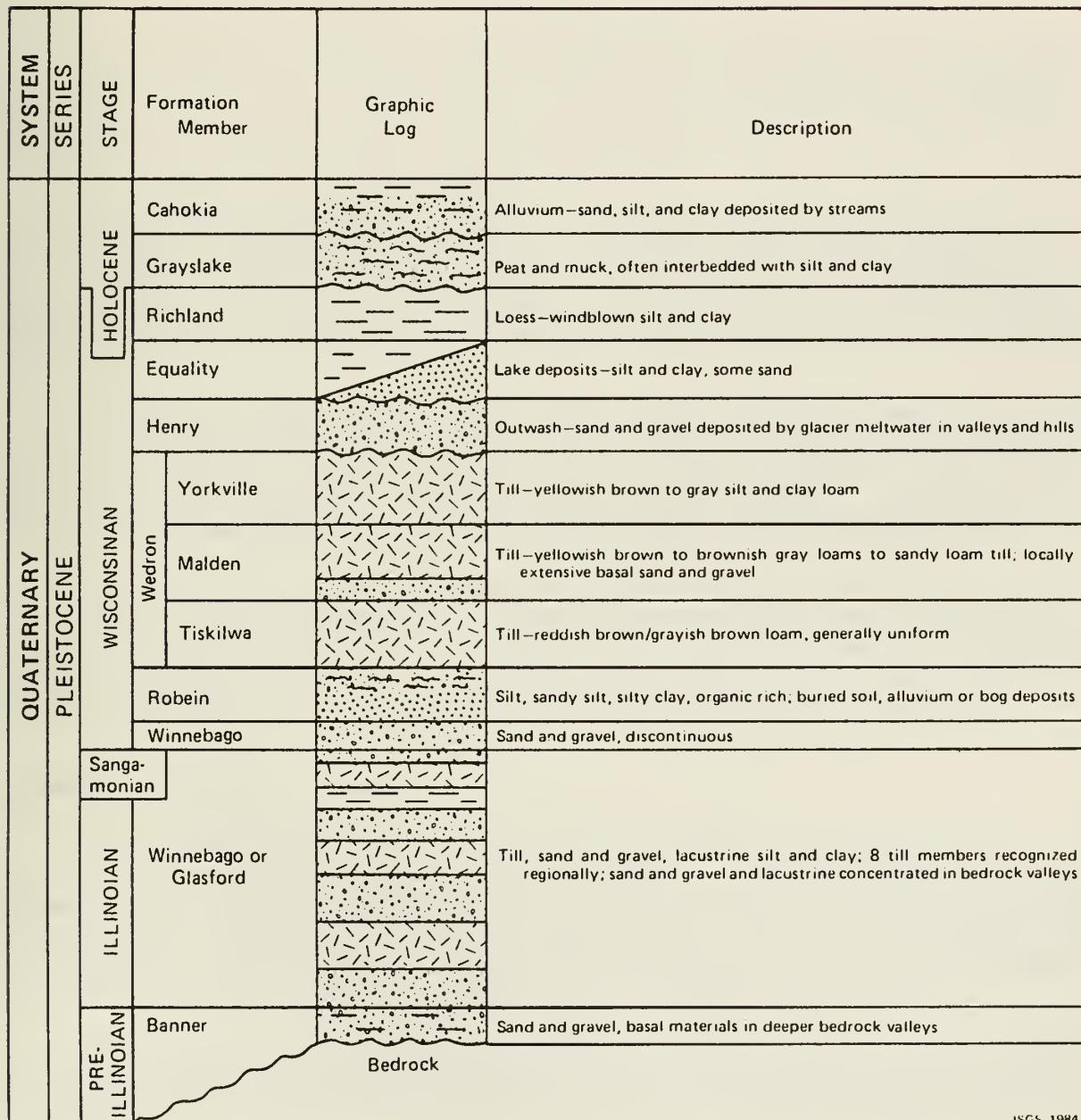


Figure 3. Location of the Kankakee Arch and adjacent structures, Wisconsin Arch, Cincinnati Arch, Illinois Basin, and Michigan Basin, in the north-central Midcontinent Region. (From Reinertsen, 1979.)

The bedrock surface in northeastern Illinois has been modified by the Pleistocene glaciers that repeatedly covered the area during the last 700,000 years. Some of the irregularities of the bedrock surface that were produced by pre-Pleistocene erosion were accentuated by meltwater from the early glaciers; however, some of the valleys were later filled so completely with glacial drift that in many places no surface expression of them is now visible and present-day drainage does not, for the most part, follow them. Bedrock exposures show well-developed scratches, called striations, which prove that the higher parts of the bedrock surface were scraped, ground, and rounded by the overriding glacial ice. Its entrained rock debris acted as a giant piece of sandpaper. The ice sheet itself was several thousand feet thick and extremely heavy when it crossed this region. Glacial deposits, being relatively weak, were easily eroded by each succeeding glacier and became incorporated into the newly forming glacial material, called till, that blankets the area. Till is a mixture of rock fragments of many types and sizes. The overall effect of glaciation in this region has been to subdue the pre-Pleistocene topography (also see attached "Pleistocene Glaciations in Illinois").

Although Pleistocene glaciers have covered nearly 85 percent of Illinois at one time or another during the past two million years or so, no deposits definitely identified as pre-Illinoian have been found in northeastern Illinois. If pre-Illinoian glaciers did extend into this part of our state, erosion during subsequent glaciations has removed all evidence of them. Illinoian tills to the west and southwest of the Chicago area indicate that Illinoian glaciers did advance southward through the Lake Michigan Basin and did cover this region. Subsequent weathering and erosion, followed by Wisconsinan glaciation, obliterated all traces of Illinoian glaciation from the field trip area, however.

Wisconsinan tills of the Woodfordian Substage deposited from about 14,000 to 12,000 years ago underlie this area; here the till of the Wedron Formation ranges from zero to more than 200 feet thick (fig. 4).



ISGS 1984

Figure 4.

Stratigraphic column of drift (Quaternary) deposits in northern Illinois. From Kempton et al., 1985.

As the Woodfordian glacier melted, a series of lakes formed filling low areas between the ice margin and the adjacent higher land of the end moraines surrounding what is now the Lake Michigan Basin. Some of these lakes were larger than present-day Lake Michigan, which reached its present elevation and size about 2,000 years ago. The glacial deposits underlying the lakes have been reworked by waves and currents; those deposits not inundated by the lakes have been subjected to wind and running water to produce the land forms seen today.

MINERAL PRODUCTION

Mineral resources extracted from Du Page and Kane Counties include sand and gravel, and stone. In addition, several mineral materials that originate from outside the area and the State are processed here.

During 1983, the last year for which complete mineral production records are available, of the 102 counties in Illinois, 99 reported mineral production. The total value of all minerals extracted from Illinois was more than \$2.9 billion. The total value of all minerals extracted, processed, or manufactured in the State was more than \$3.6 billion.

Du Page County ranked 52nd among the mineral producing counties of the State in 1982. Two producers operated 3 sand and gravel pits; there was 1 stone producer. Exfoliated vermiculite is manufactured here in addition to clay products. Because there are only 1 or 2 operators per mineral category, tonnage and value figures are confidential in order to protect the individual operators.

Kane County ranked 34th in 1982 with a produced value in excess of \$16.6 million. Seven producers with 12 operations mined more than 4.2 million tons of sand and gravel in 1984, valued in excess of \$13.2 million. Three stone producers quarried more than 725,000 tons of stone in 1983. Kane County also listed iron oxide pigments production and two clay products manufacturers.

The close proximity of the sand and gravel and stone operations to the large market area in northeastern Illinois greatly reduces the shipping costs on these high bulk materials. To conserve construction materials, long-range planning is necessary so that future pit sites having thin overburden do not become covered and lost to housing developments and shopping centers.

GROUNDWATER RESOURCES

Several communities in Kane County use the Cambrian-age Ironton and Galesville Formations for municipal water supplies. These deeply buried sandstones contain abundant groundwater resources, but recent analyses have shown that the water from these aquifers in some areas contains barium and/or radium in amounts that exceed federal standards for drinking water. These elements occur naturally and are not derived from any man-caused pollution.

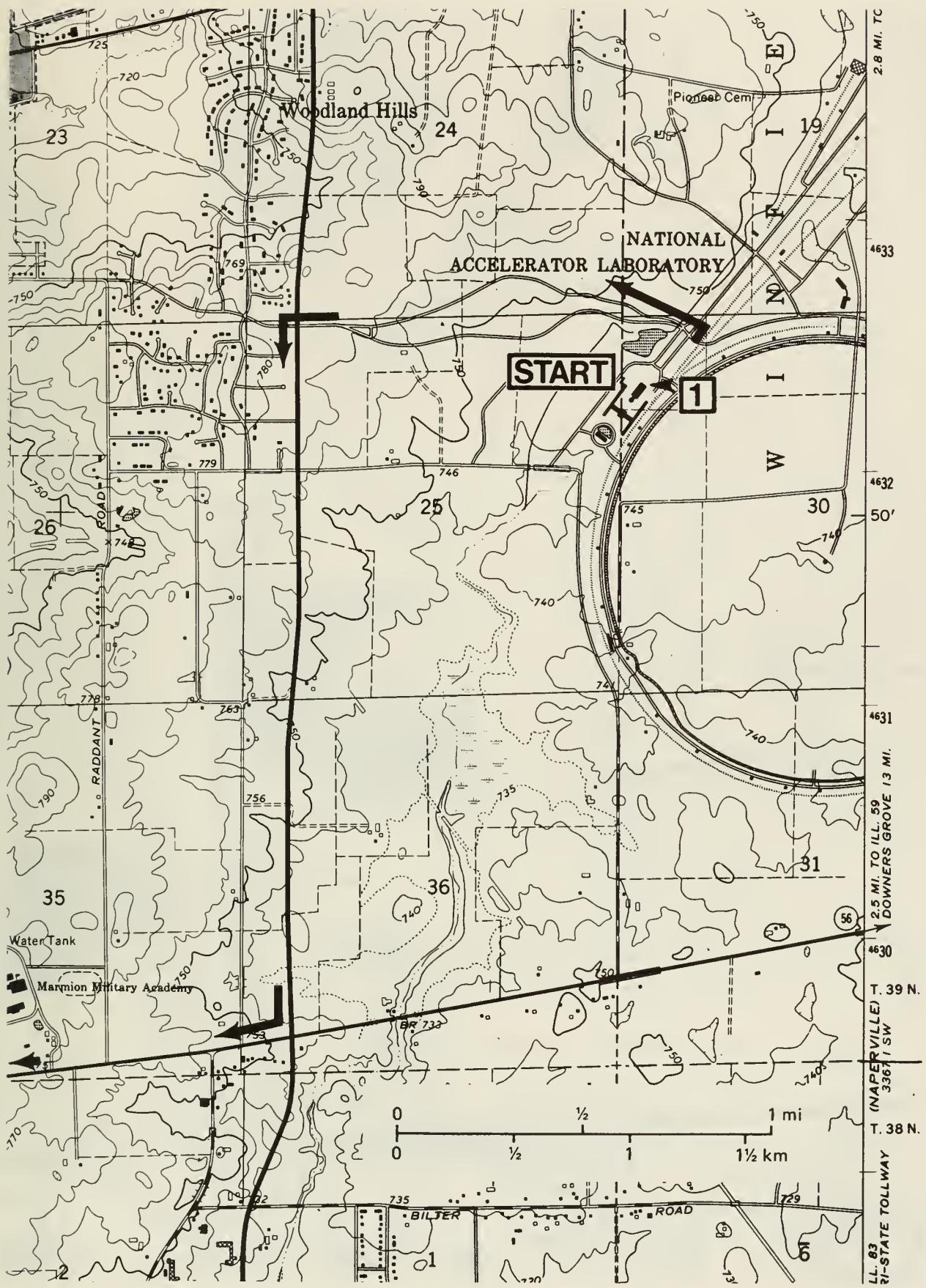
ISGS scientists are assisting several Fox Valley communities in locating alternative sources of groundwater low in barium and radium that can be used to supplement and dilute the supplies from the Cambrian aquifers so that the

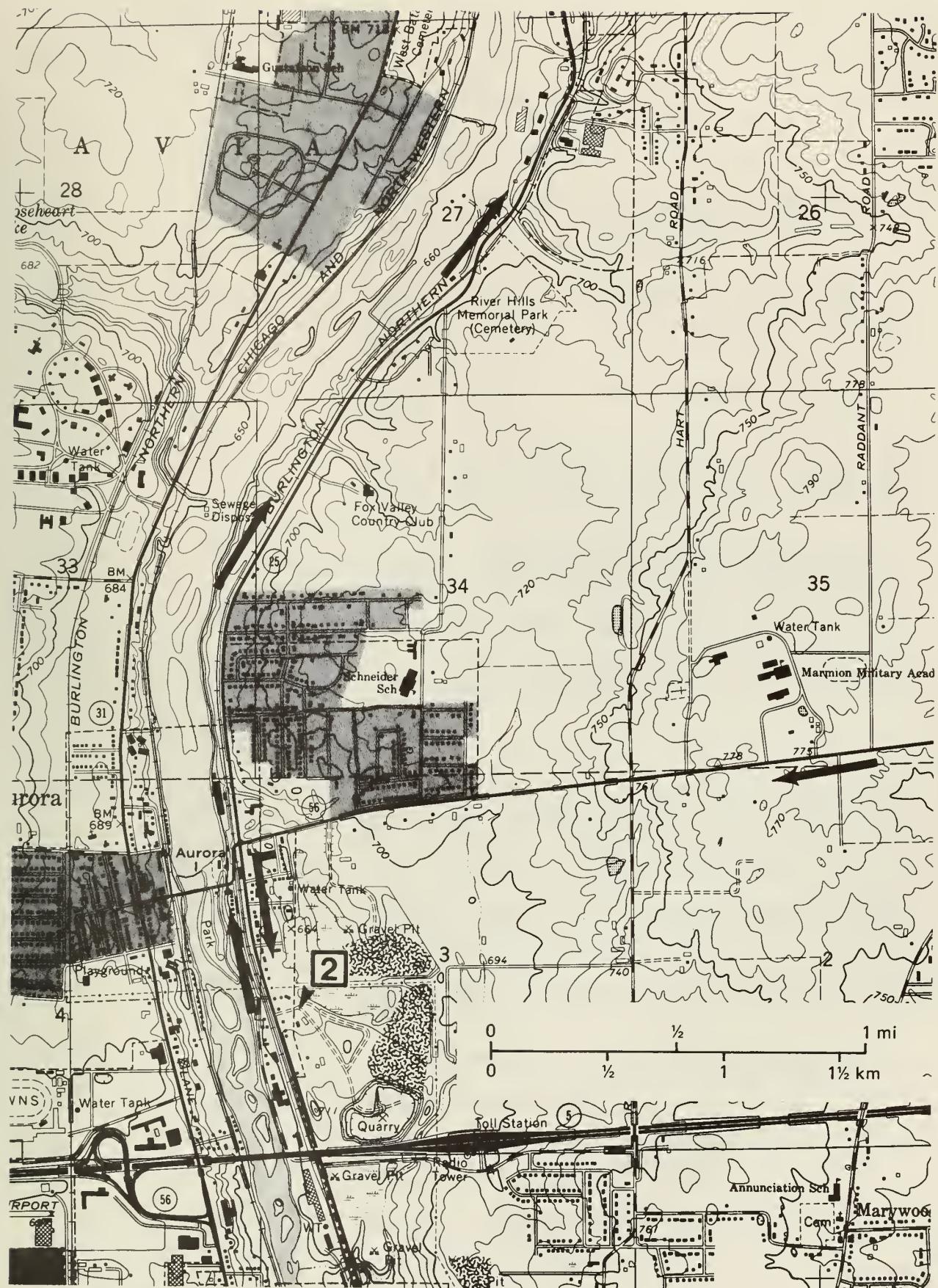
water quality can be brought into compliance with the EPA Standards. Electrical earth resistivity and seismic refraction geophysical prospecting methods are being used to locate aquifers in the glacial drift that contain sufficient resources for municipal water supplies. Several new wells have been completed successfully in the last 18 months.

The new shallower wells in the glacial drift are much less costly to operate than the deep wells, because of lower pumping costs, but do not contain sufficient groundwater resources to completely replace the supplies from the deep aquifers. Supplying Lake Michigan water to the communities of the Fox Valley is far more costly than continuing to pump from the deep Ironton/Galesville sandstones at depths of about 3,000 feet beneath the ground.

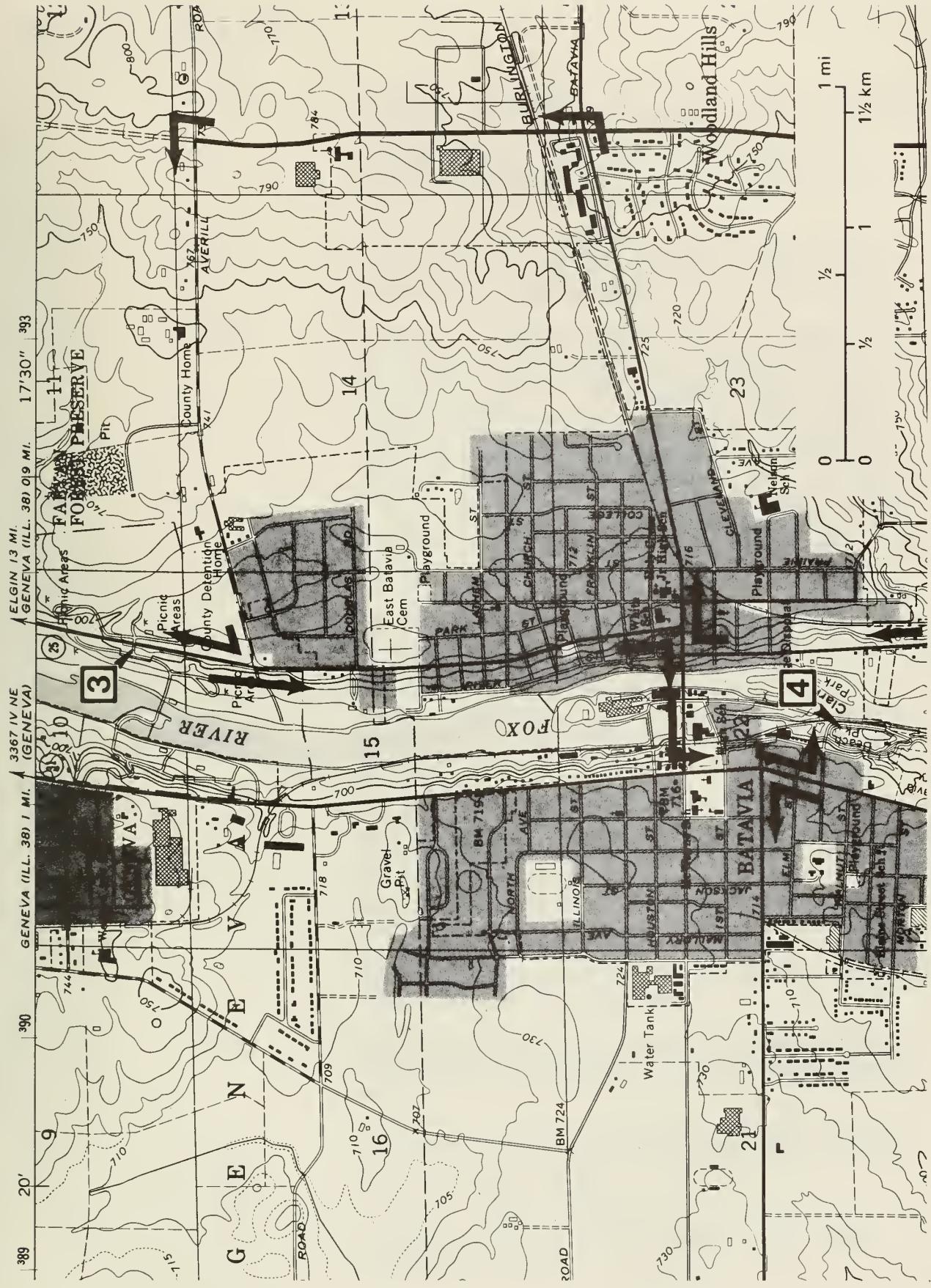
GUIDE TO THE ROUTE

Miles to next point	Miles from start	
		Assemble in the parking lot on the northwest side of Wilson Hall, the 16-story concrete building at Fermilab. The tour of Fermilab facilities is STOP 1 of the field trip.
0.0	0.0	STOP (1-way): northeast corner of parking lot. TURN RIGHT (southeast) as you exit from lot.
0.0+	0.0+	STOP (2-way): CONTINUE AHEAD past the row of national flags.
0.05-	0.05	TURN LEFT (northeast) on the 1-way street alongside the reflecting pool. Keep to the left and prepare to turn left.
0.1+	0.15+	STOP (1-way): divided roadway. TURN LEFT (northwest).
0.05-	0.2+	STOP (2-way): CONTINUE AHEAD (northwesterly) and note the gently undulating land surface (topography).
0.9-	1.05+	Entrance guard house.
0.05	1.1+	Entrance ornamental steel archway designed by Director Wilson.
0.15-	1.25	CAUTION: STOPLIGHT; intersection of Pine Street and Kirk Road. TURN LEFT (south) on Kirk Road.
0.75	2.0	Note the gently undulating topography on both sides of Kirk Road here along the backslope of the Minooka Moraine. The morainal crest is about 0.5 mile to the right (west).
0.05	2.05	Abandoned Chicago, Aurora and Elgin (CA&E) Railroad crossing.
1.0	3.05	Prepare to turn right.
0.1-	3.15-	CAUTION: STOPLIGHT; Butterfield Road. TURN RIGHT (westerly) on State Route (SR) 56.
0.5+	3.65	Note gravelly Yorkville Till of the Wedron Formation (Pleistocene) in the ditch to the right for about 0.25 mile.
0.4-	4.05-	Approximate crest of the Minooka Moraine. The view ahead is across the St. Charles ground moraine down the slope, thence across the Fox River to the St. Charles end moraine.



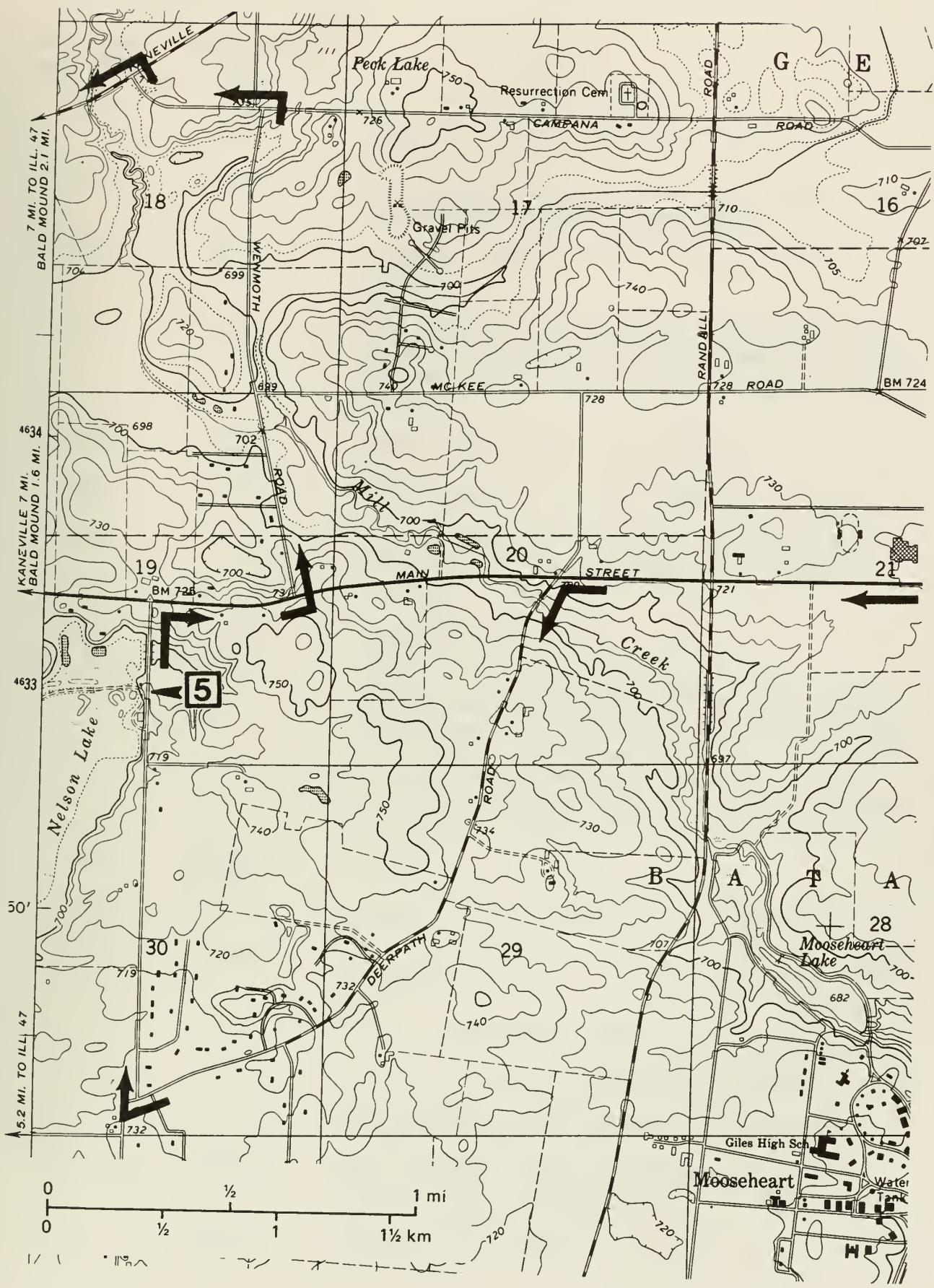


Miles to next point	Miles from start	
0.65	4.7-	CAUTION: enter North Aurora.
0.5	5.2-	Prepare to turn left.
0.1+	5.3+	CAUTION: STOPLIGHT; River Road. TURN LEFT (south) on SR 25. Do NOT cross Burlington Northern (BN) Railroad tracks.
0.45+	5.75+	TURN LEFT (east) at entrance to Conco Stone Company. You MUST have permission to enter this property. STOP 2. Silurian dolomite exposed in Conco quarry.
0.0	5.75+	Leave Stop 2. Resume mileage at entrance. STOP (1-way) at River Road. TURN RIGHT (north) on SR 25.
0.45+	6.25-	CAUTION: STOPLIGHT; Butterfield Road (SR 56). CONTINUE AHEAD (north) on River Road (SR 25).
1.75+	8.0+	CAUTION: guarded 1-track BN RR crossing.
0.15+	8.15+	Cross over abandoned CA&E RR grade that has been converted to a bike path.
0.35-	8.5	CAUTION: enter Batavia.
0.9-	9.4-	CAUTION: STOPLIGHT; Wilson Street. TURN RIGHT (east) and ascend east valley wall of the Fox River which here consists of valley train deposits overlying bedrock of Silurian age.
0.05+	9.45+	CAUTION: STOPLIGHT; Washington Street (SR 25). CONTINUE AHEAD on Wilson Street.
0.15	9.6+	STOP (4-way). CAUTION: just beyond stop is a guarded 1-track BN RR crossing.
0.5-	10.1	Cross a lower portion of the Minooka Moraine.
0.6	10.7	Prepare to turn left.
0.1+	10.8+	CAUTION: STOPLIGHT. TURN LEFT (north) on Kirk Road; stay in the inside lane.
0.1+	10.9+	CAUTION: guarded single-track BN RR crossing.
0.8	11.7+	Prepare to turn left.



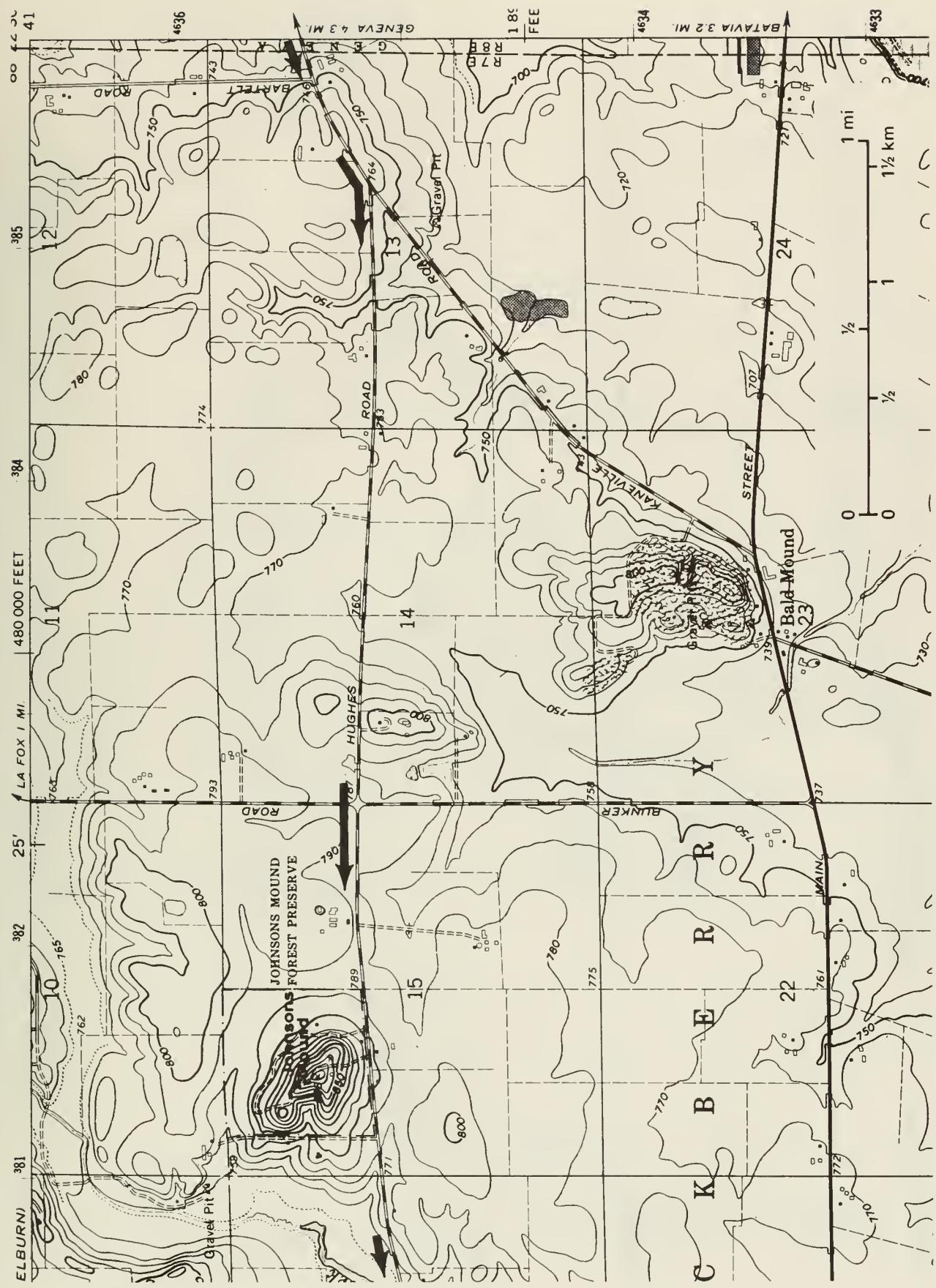
Miles to next point	Miles from start	
0.1+	11.85	CAUTION: STOPLIGHT. TURN LEFT (west) on Fabyan Parkway and move to the outside lane. This intersection is located along the crest of the Minooka Moraine at an elevation of about 790 feet above mean sea level (msl).
0.15	12.0	To the right are several views of the large Settler's Hill sanitary landfill. The itinerary descends the outer margin of the Minooka Moraine.
0.3+	12.3+	Entrance to Settler's Hill sanitary landfill on the right. This landfill was started in 1967 by four owner/partners who sold the operation to Waste Management, Inc. (WMI) in 1980. Negotiations ensued with Kane County concerning the eventual disposition of the property for recreational purposes. A short, par-3 golf course has been put in recently. It will test the integrity of the soil cover. Another area is ready for construction of a 9-hole course, eventually to be enlarged to 18 holes. The barns and some of the land was once part of the county farm. They raised their own crops and livestock. The county has retained the old buildings with the intent of remodeling them for use in conjunction with the golf course when it is completed; included will be a clubhouse, a pro-shop, restaurant, maintenance, etc.
		The present landfill has a life expectancy of 8 to 9 years. WMI has recently purchased adjoining additional property to extend the life of the operation for nearly 20 years. This will provide additional recreational area for another 18-hole course, ski hill, lake for paddle-boats, etc.
		The landfill is open for small tours for school groups with prior arrangement.
0.45-	12.75	Kane County Corrections Complex to the right. The itinerary crosses St. Charles ground moraine here.
0.2	12.95	This area is underlain by valley train deposits.
0.2	13.15	Prepare to turn right.
0.1+	13.25+	CAUTION: STOPLIGHT; River Road. TURN RIGHT (north) on SR 25.

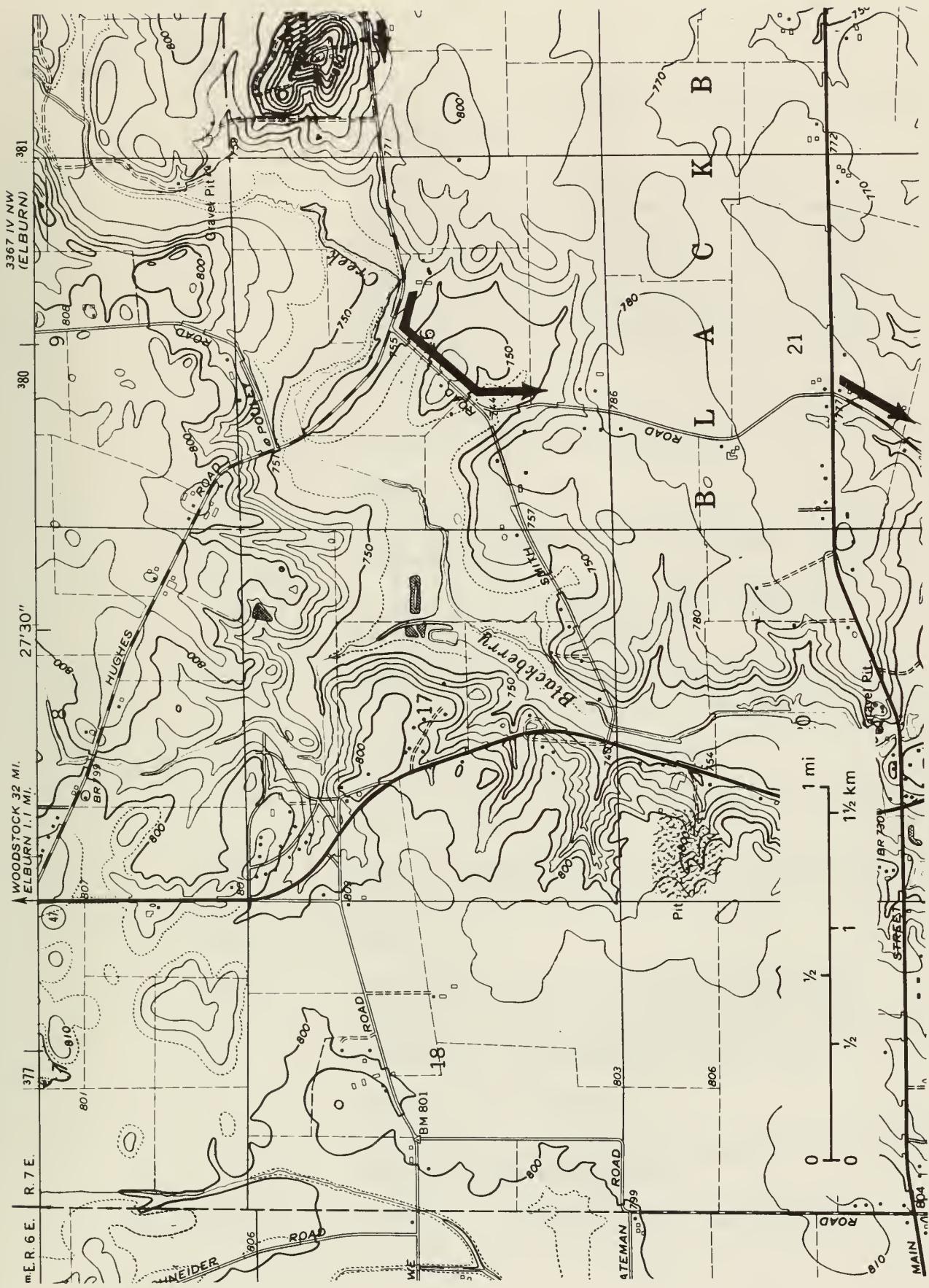
Miles to next point	Miles from start	
0.25	13.5+	Prepare to turn left.
0.1-	13.6	CAUTION: fast opposing traffic/limited visibility. TURN LEFT into Fabyan Forest Preserve. NOTE: mileage figures will resume at entrance. Proceed to lower parking area and picnic shelter.
		STOP 3. Lunch followed by discussion of Fox River development.
0.0	13.6	Leave Stop 3. STOP (2-way); River Road. TURN RIGHT (south) <u>with</u> EXTREME CAUTION on SR 25. Limited visibility and fast traffic from left.
0.3+	13.9+	CAUTION: STOPLIGHT; Fabyan Parkway. CONTINUE AHEAD (south).
0.4+	14.35	CAUTION: Batavia city limits.
0.7+	15.05+	CAUTION: STOPLIGHT; Wilson Street. TURN RIGHT (west), descend the Fox Valley wall, and enter the business district.
0.05+	15.1+	CAUTION: STOPLIGHT; River Street. CONTINUE AHEAD (west).
0.05	15.15+	Cross Fox River bridge.
0.05+	15.25-	CAUTION: STOPLIGHT; Island Avenue. CONTINUE AHEAD (west).
0.1+	15.35+	TURN LEFT (south) on Water Street along the west side of the small shopping center.
0.1-	15.45	STOP (2-way). CONTINUE AHEAD (south).
0.25+	15.7+	STOP (4-way); Union Avenue. TURN LEFT (east) and descent west Fox Valley wall toward Quarry Park.
0.05+	15.8+	BEAR RIGHT (south) and enter Quarry Park. Mileage resumes here on return. NOTE: macadam "speed" bumps cross the park drive.
		STOP 4. Discussion of Silurian bedrock strata exposed in the park and multiple land use.
0.0	15.8+	Leave Stop 4 and retrace route to entrance. STOP (2-way). TURN LEFT (west) and ascend Union Avenue hill.



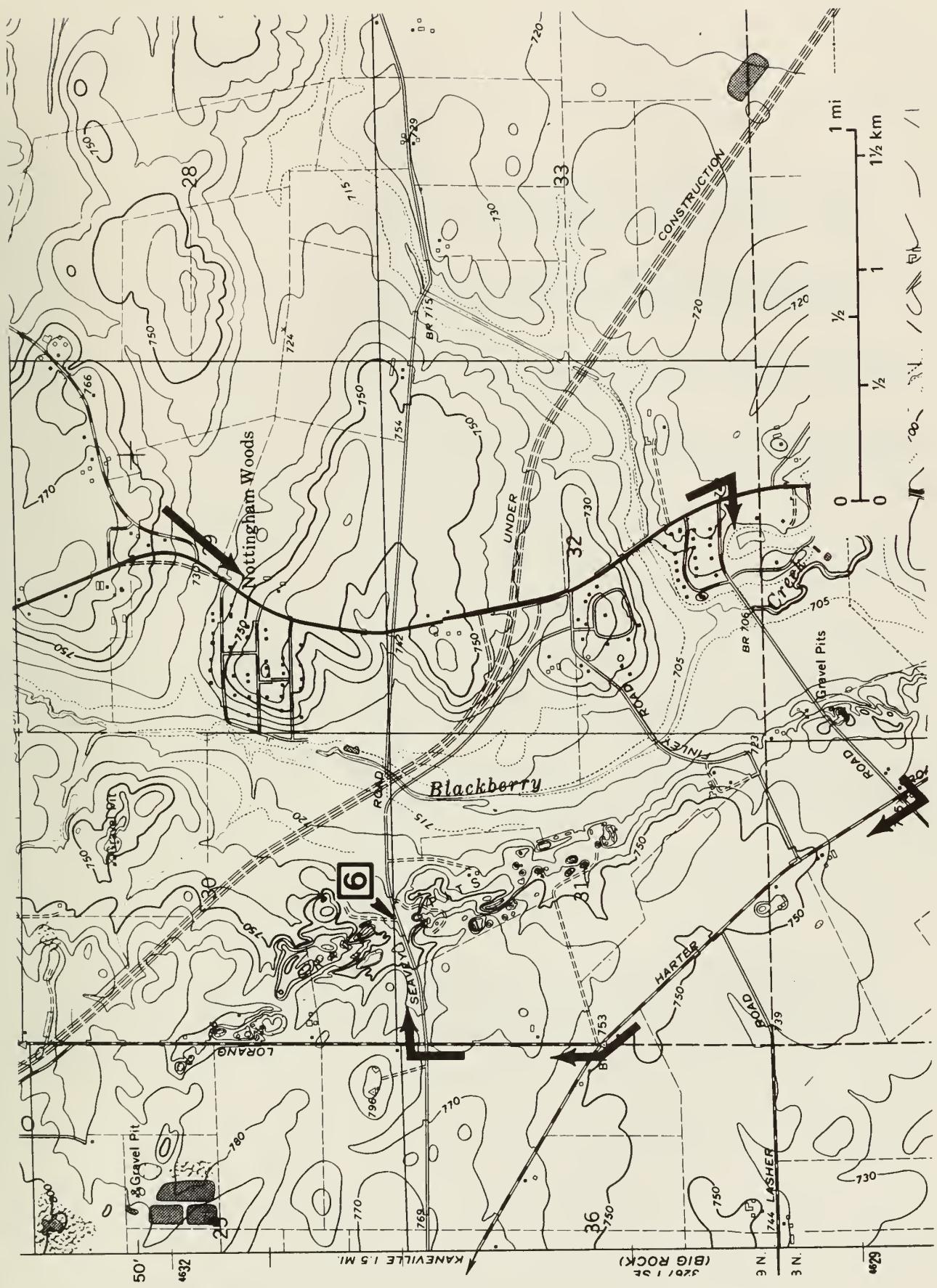
Miles to next point	Miles from start	
0.05+	15.85+	STOP (4-way); Water Street. CONTINUE AHEAD (west).
0.05+	15.95-	STOP (2-way); Batavia Avenue. TURN RIGHT (north) on SR 31 and prepare to turn left.
0.15+	16.1+	CAUTION: STOPLIGHT; Main Street. TURN LEFT (west).
0.3+	16.4+	STOP (4-way); Jackson Street. CONTINUE AHEAD (west). Note that Main Street gradually rises to the west toward the backslope of the St. Charles Moraine.
0.5+	16.95	Batavia High School to the right.
0.05-	17.0-	Engstrom Family Park to the left.
0.6+	17.6	STOP (4-way); Randall Road. CONTINUE AHEAD (west) on Main Street across the St. Charles Moraine.
0.3	17.9	Prepare to turn left.
0.1	18.0	TURN LEFT (southerly) on Deerpath Road. The route ahead is quite scenic with a good development of swell and swale topography on both sides of the road. The rather tortuous road has been laid out around the swampy low areas on the moraine. The highest part of the moraine along the road is slightly more than 740 feet msl.
1.85	19.85	Prepare to turn right.
0.05+	19.9+	SHARP RIGHT TURN (north) on to Nelson Lake Road.
1.05	20.95+	TURN LEFT and park in lot for Nelson Lake Forest Preserve.
		STOP 5. Nelson Lake peat bog discussion.
0.0	20.95+	Leave Stop 5 and CONTINUE AHEAD (north).
0.15	21.1+	Cross northeast part of Nelson Lake peat bog.
0.1+	21.25+	STOP (1-way); T-road intersection. TURN RIGHT (east) on Main Street.
0.3-	21.55	Prepare to turn left.

Miles to next point	Miles from start	
0.1-	21.65-	TURN LEFT (north) on Wenmoth Road. Note till exposure in road cut on Wenmoth Road.
0.05+	21.7	To the left is a depression formed when peat was removed from a bog. In the distance ahead is the Gilberts Moraine.
0.4	22.1	Cross Mill Creek.
0.65+	22.75+	Gravelly till is exposed in the road cut on the right.
0.2+	22.95+	STOP (1-way); T-road intersection with Fabyan Parkway. TURN LEFT (west) with CAUTION; limited visibility.
0.35+	23.3+	CAUTION: "Y" intersection with Kaneville Road. BEAR LEFT (southwesterly) on Kaneville Road.
0.15-	23.45+	Cross Mill Creek.
0.2-	23.65	Ascend St. Charles Moraine.
0.15+	23.8+	Excellent view to left from this high point on the St. Charles Moraine is down across the ground moraine toward Batavia and Mooseheart along the Fox River.
0.1	23.9+	Prepare to turn right.
0.1-	24.0	TURN RIGHT (west) on to Hughes Road at "r" intersection; road to Elburn.
0.7	24.7	View to left of Bald Knob, a kame with a summit elevation of approximately 810 feet msl before mining of the sand and gravel began. The stock piles noted here are the ones that are seen near the horizon from the 15th floor of Wilson Hall; nearly 7 miles west-northwest from Fermilab.
0.3	25.0	View to right of Gilberts Moraine on the horizon.
0.4+	25.4+	The crest of this kame lies just a short distance to the left near the house. The summit elevation is nearly the same as Bald Knob, 810 feet msl, but it doesn't seem as high because the immediately surrounding land is at a higher surface elevation.





Miles to next point	Miles from start	
0.25-	25.65	STOP (2-way); Bunker Road. CONTINUE AHEAD (west) on Hughes Road.
0.35	26.0	The large tree-covered hill just ahead is the Johnson Mound Forest Preserve. This kame with a summit elevation of 898 feet msl rises about 110 feet above the surrounding land. Its height is close to that of several kames within a 4- to 5-mile radius to the north. However, Johnson's Mound appears higher because of its relatively steep sides. Itinerary is across the Gilberts Moraine here.
0.25	26.25	Entrance to Johnson's Mound Forest Preserve on the right. CONTINUE AHEAD (west).
0.75	27.0	Prepare to turn left.
0.1	27.1	TURN LEFT (southerly) on Green Road at T-road intersection.
0.35	27.45	Y-intersection with Smith Road. BEAR LEFT (southerly) on Green Road.
0.95+	28.4+	STOP (2-way); Main Street. CONTINUE AHEAD STRAIGHT (southwesterly) on Green Road.
0.5-	28.9	Another peat bog to the right.
0.85-	29.75-	STOP (1-way); T-road intersection with SR 47. TURN LEFT (southerly).
0.8+	30.55	West entrance ramp to East-West Tollroad (IL-5). CONTINUE AHEAD (southerly) on SR 47.
0.1	30.65	Cross IL-5.
0.4-	31.05-	Drainageway from the northeast to southwest through here has a very gentle bottom slope (gradient) resulting in sufficient standing water to maintain a lush growth of bog plants.
0.1	31.15-	Prepare to turn right.
0.1+	31.25+	TURN RIGHT (west and then southwesterly) on Scott Road at T-road intersection.
0.2+	31.45+	Crossroads. CONTINUE AHEAD (southwesterly).



Miles to next point	Miles from start	
0.1	31.55+	Cross Blackberry Creek. Gravel road just beyond bridge.
0.1-	31.65	Valley floor underlain by valley train deposits here. The ridge ahead extending from right to left for some distance is the Kaneville Esker.
0.2+	31.85+	The route is ascending the flank of the Kaneville Esker. To the right and left are abandoned gravel pits.
0.1	31.95+	Cross the crest of the Kaneville Esker; slightly more than 750 feet msl.
0.25+	32.2+	STOP (2-way); crossroads. TURN RIGHT (northwest) on Harter Road.
0.45	32.65+	A small kame is to the left.
0.5-	33.15	Prepare to turn right.
0.1+	33.25+	TURN RIGHT (north) on Lorang Road (gravel).
0.45+	33.7+	Crossroads: TURN RIGHT (east) on Seavey Road.
0.15+	33.85+	This is the approximate southwest side of the Kaneville Esker before it was mined out here.
0.2	34.05+	Entrance to Kane County Highway Department salt storage area to left. You MUST have permission to enter these premises.

STOP 6. Deposits of the Kaneville Esker.

End of field trip!

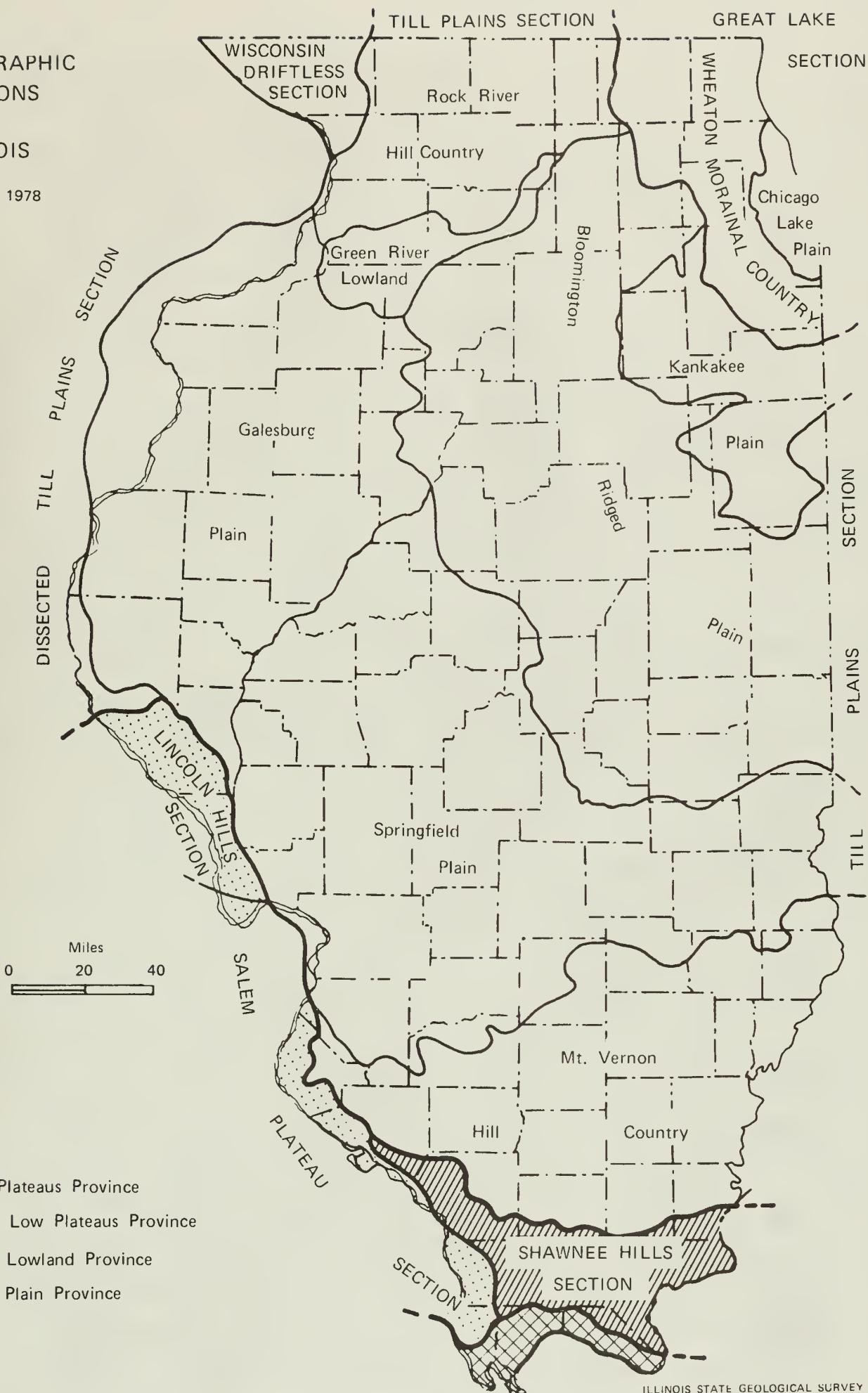
To get home: slightly less than 1 mile ahead (southeast) from here is a crossroad; TURN LEFT for 0.1 mile to intersect with SR 47. TURN LEFT for De Kalb, Elburn, Elgin, etc.; TURN RIGHT for Sugar Grove, Aurora, Batavia, Yorkville, etc.

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PHYSIOGRAPHIC
DIVISIONS
OF
ILLINOIS

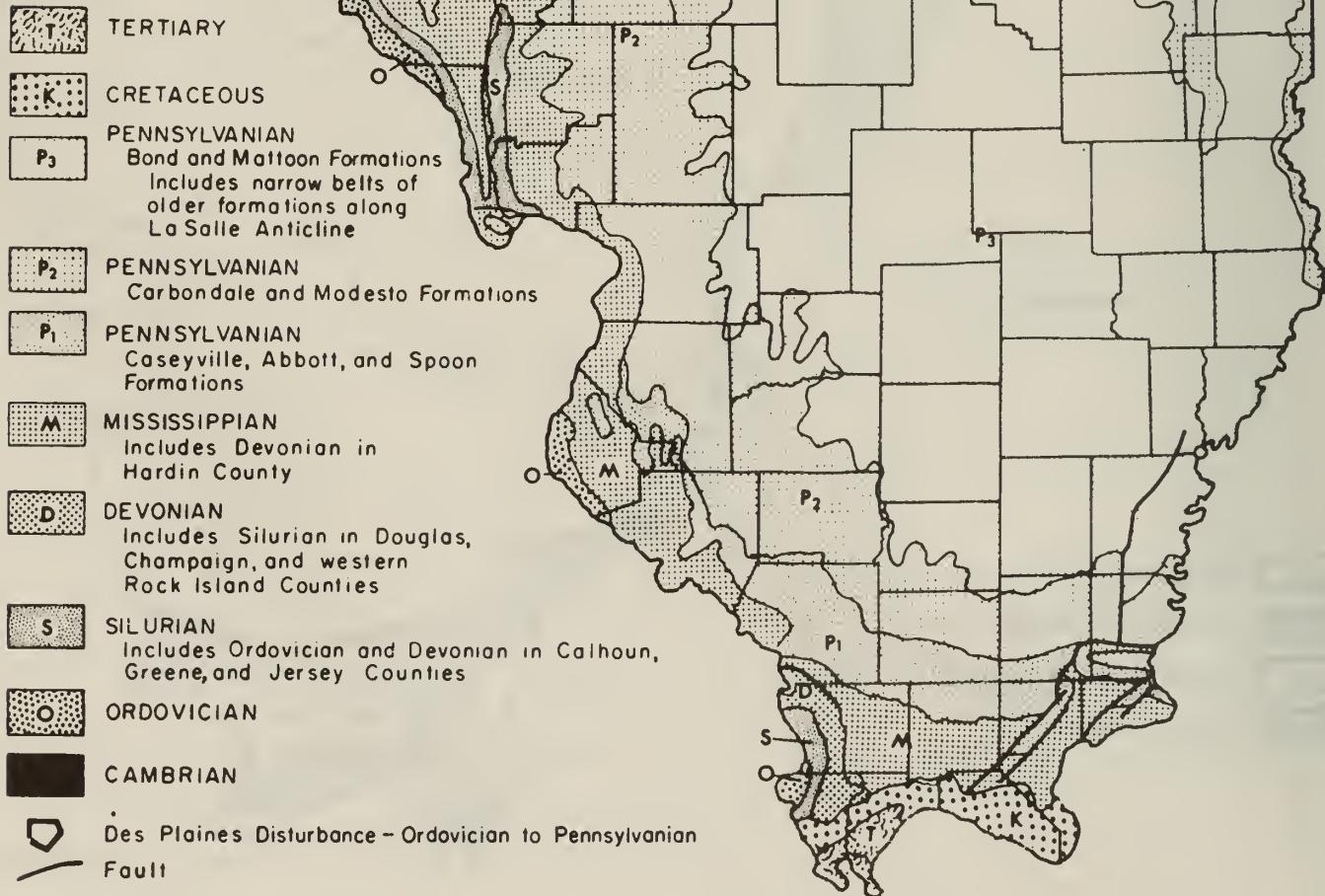
Reprinted 1978



GEOLOGIC MAP

0 20 40 60 Miles
0 40 80 Kilometers

Pleistocene and
Pliocene not shown



PLEISTOCENE GLACIATIONS IN ILLINOIS

Origin of the Glaciers

During the past million years or so, the period of time called the Pleistocene Epoch, most of the northern hemisphere above the 50th parallel has been repeatedly covered by glacial ice. Ice sheets formed in sub-arctic regions four different times and spread outward until they covered the northern parts of Europe and North America. In North America the four glaciations, in order of occurrence from the oldest to the youngest, are called the Nebraskan, Kansan, Illinoian, and Wisconsinan Stages of the Pleistocene Epoch. The limits and times of the ice movement in Illinois are illustrated in the following pages by several figures.

The North American ice sheets developed during periods when the mean annual temperature was perhaps 4° to 7° C (7° to 13° F) cooler than it is now and winter snows did not completely melt during the summers. Because the cooler periods lasted tens of thousands of years, thick masses of snow and ice accumulated to form glaciers. As the ice thickened, the great weight of the ice and snow caused them to flow outward at their margins, often for hundreds of miles. As the ice sheets expanded, the areas in which snow accumulated probably also increased in extent.

Tongues of ice, called lobes, flowed southward from the Canadian centers near Hudson Bay and converged in the central lowland between the Appalachian and Rocky Mountains. There the glaciers made their farthest advances to the south. The sketch below shows several centers of flow, the general directions of flow from the centers, and the southern extent of glaciation. Because Illinois lies entirely in the central lowland, it has been invaded by glaciers from every center.

Effects of Glaciation

Pleistocene glaciers and the waters melting from them changed the landscapes they covered. The glaciers scraped and smeared the landforms they overrode, leveling and filling many of the minor valleys and even some of the larger ones. Moving ice carried colossal amounts of rock and earth, for much of what the glaciers wore off the ground was kneaded into the moving ice and carried along, often for hundreds of miles.



The continual floods released by melting ice entrenched new drainageways, deepened old ones, and then partly refilled both with sediments as great quantities of rock and earth were carried beyond the glacier fronts. According to some estimates, the amount of water drawn from the sea and changed into ice during a glaciation was probably enough to lower sea level more than 300 feet below present level. Consequently, the melting of a continental ice sheet provided a tremendous volume of water that eroded and transported sediments.

In most of Illinois, then, glacial and meltwater deposits buried the old rock-ribbed, low, hill-and-valley terrain and created the flatter landforms of our prairies. The mantle of soil material and the deposits of gravel, sand, and clay left by the glaciers over about 90 percent of the state have been of incalculable value to Illinois residents.

Glacial Deposits

The deposits of earth and rock materials moved by a glacier and deposited in the area once covered by the glacier are collectively called drift. Drift that is ice-laid is called till. Water-laid drift is called outwash.

Till is deposited when a glacier melts and the rock material it carries is dropped. Because this sediment is not moved much by water, a till is unsorted, containing particles of different sizes and compositions. It is also unstratified (unlayered). A till may contain materials ranging in size from microscopic clay particles to large boulders. Most tills in Illinois are pebbly clays with only a few boulders.

Tills may be deposited as end moraines, the arc-shaped ridges that pile up along the glacier edges where the flowing ice is melting as fast as it moves forward. Till also may be deposited as ground moraines, or till plains, which are gently undulating sheets deposited when the ice front melts back, or retreats. Deposits of till identify areas once covered by glaciers. North-eastern Illinois has many alternating ridges and plains, which are the succession of end moraines and till plains deposited by the Wisconsinan glacier.

Sorted and stratified sediment deposited by water melting from the glacier is called outwash. Outwash is bedded, or layered, because the flow of water that deposited it varied in gradient, volume, velocity, and direction. As a meltwater stream washes the rock materials along, it sorts them by size--the fine sands, silts, and clays are carried farther downstream than the coarser gravels and cobbles. Typical Pleistocene outwash in Illinois is in multilayered beds of clays, silts, sands, and gravels that look much like modern stream deposits.

Outwash deposits are found not only in the area covered by the ice field but sometimes far beyond it. Meltwater streams ran off the top of the glacier, in crevices in the ice, and under the ice. In some places, the cobble-gravel-sand filling of the bed of a stream that flowed in the ice is preserved as a sinuous ridge called an esker. Cone-shaped mounds of coarse outwash, called kames, were formed where meltwater plunged through crevasses in the ice or into ponds along the edge of the glacier.

The finest outwash sediments, the clays and silts, formed bedded deposits in the ponds and lakes that filled glacier-dammed stream valleys, the sags of the till plains, and some low, moraine-diked till plains. Meltwater streams that entered a lake quickly lost speed and almost immediately dropped the sands and gravels they carried, forming deltas at the edge of the lake. Very fine sand and silts were moved across the lake bottom by wind-generated

currents, and the clays, which stayed in suspension longest, slowly settled out and accumulated with them.

Along the ice front, meltwater ran off in innumerable shifting and short-lived streams that laid down a broad, flat blanket of outwash that formed an outwash plain. Outwash was also carried away from the glacier in valleys cut by floods of meltwater. The Mississippi, Illinois, and Ohio Rivers occupy valleys that were major channels for meltwaters and were greatly widened and deepened during times of the greatest meltwater floods. When the floods waned, these valleys were partly filled with outwash far beyond the ice margins. Such outwash deposits, largely sand and gravel, are known as valley trains. Valley trains may be both extensive and thick deposits. For instance, the long valley train of the Mississippi Valley is locally as much as 200 feet thick.

Loess and Soils

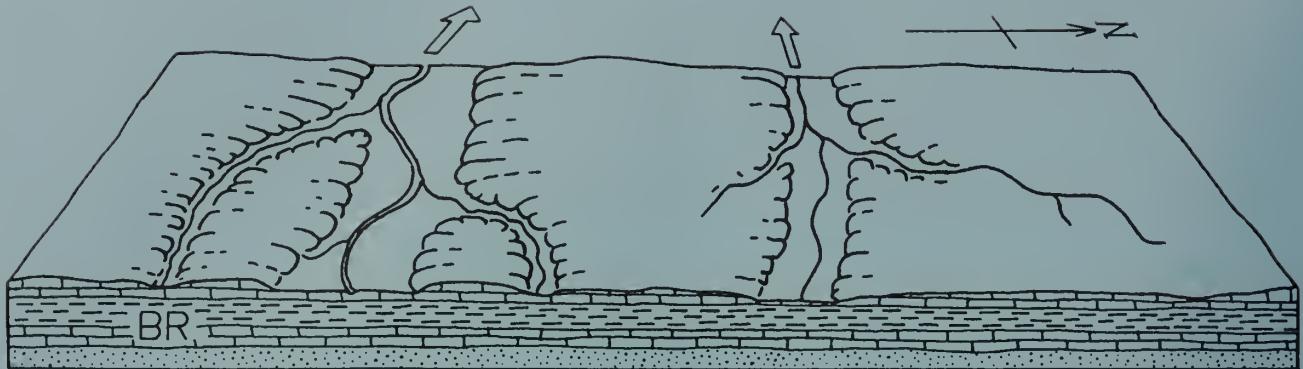
One of the most widespread sediments resulting from glaciation was carried not by ice or water but by wind. Loess is the name given to such deposits of windblown silt and clay. The silt was blown from the valley trains on the floodplains. Most loess deposition occurred in the fall and winter seasons when low temperatures caused meltwater floods to abate, exposing the surfaces of the valley trains and permitting them to dry out. During Pleistocene time, as now, west winds prevailed, and the loess deposits are thickest on the east sides of the source valleys. The loess thins rapidly away from the valleys but extends over almost all the state.

Each Pleistocene glaciation was followed by an interglacial stage that began when the climate warmed enough to melt the glaciers and their snow-fields. During these warmer intervals, when the climate was similar to that of today, drift and loess surfaces were exposed to weather and the activities of living things. Consequently, over most of the glaciated terrain, soils developed on the Pleistocene deposits and altered their composition, color, and texture. Such soils were generally destroyed by later glacial advances, but those that survive serve as keys to the identity of the beds and are evidence of the passage of a long interval of time.

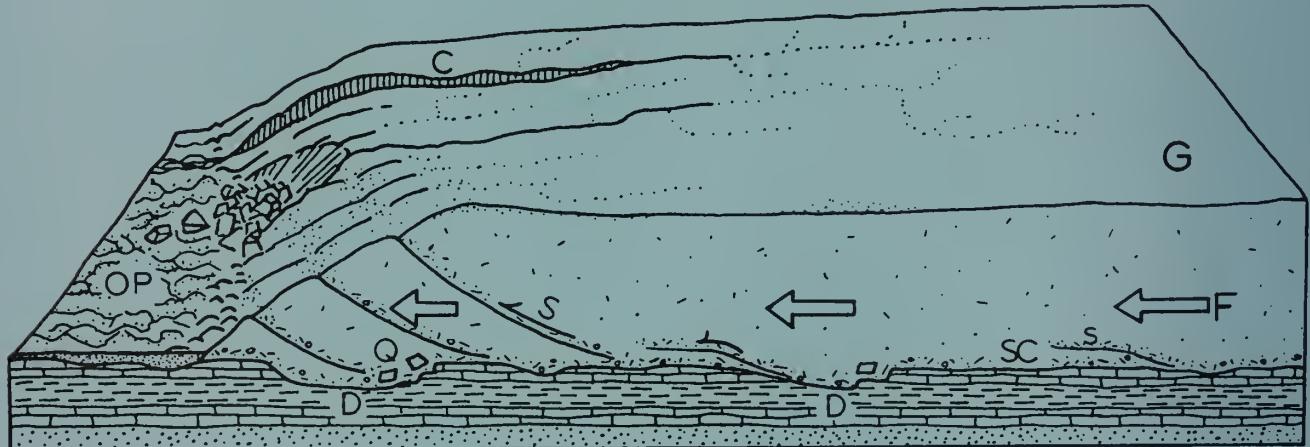
Glaciation in a Small Illinois Region

The following diagrams show how a continental ice sheet might have looked as it moved across a small region in Illinois. They illustrate how it could change the old terrain and create a landscape like the one we live on. To visualize how these glaciers looked, geologists study the landforms and materials left in the glaciated regions and also the present-day mountain glaciers and polar ice caps.

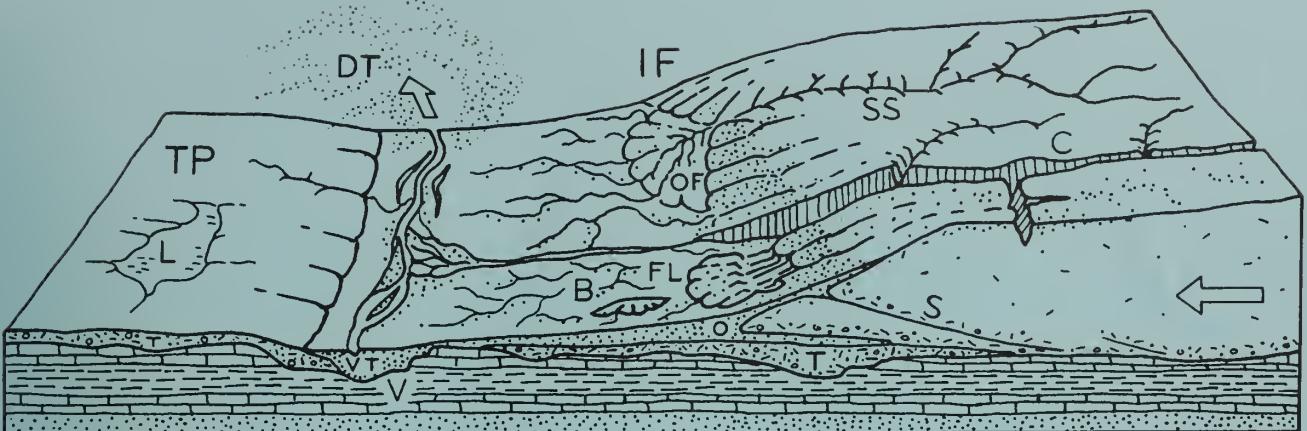
The block of land in the diagrams is several miles wide and about 10 miles long. The vertical scale is exaggerated--layers of material are drawn thicker and landforms higher than they ought to be so that they can be easily seen.



1. The Region Before Glaciation - Like most of Illinois, the region illustrated is underlain by almost flat-lying beds of sedimentary rocks--layers of sandstone (|||), limestone (||), and shale (---). Millions of years of erosion have planed down the bedrock (BR), creating a terrain of low uplands and shallow valleys. A residual soil weathered from local rock debris covers the area but is too thin to be shown in the drawing. The streams illustrated here flow westward and the one on the right flows into the other at a point beyond the diagram.



2. The Glacier Advances Southward - As the glacier (G) spreads out from its snowfield, it scours (SC) the soil and rock surface and quarries (Q)--pushes and plucks up--chunks of bedrock. These materials are mixed into the ice and make up the glacier's "load." Where roughnesses in the terrain slow or stop flow (F), the ice "current" slides up over the blocked ice on innumerable shear planes (S). Shearing mixes the load very thoroughly. As the glacier spreads, long cracks called "crevasses" (C) open parallel to the direction of ice flow. The glacier melts as it flows forward, and its meltwater erodes the terrain in front of the ice, deepening (D) some old valleys before the ice covers them. Meltwater washes away some of the load freed by melting and deposits it on the outwash plain (OP). The advancing glacier overrides its outwash and in places scours much of it up again. The glacier may be 5000 or so feet thick , except near its margin. Its ice front advances perhaps as much as a third of a mile per year.



3. The Glacier Deposits an End Moraine - After the glacier advanced across the area, the climate warmed and the ice began to melt as fast as it advanced. The ice front (IF) is now stationary, or fluctuating in a narrow area, and the glacier is depositing an end moraine.

As the top of the glacier melts, some of the sediment that was mixed in the ice accumulates on top of the glacier. Some is carried by meltwater onto the sloping ice front (IF) and out onto the plain beyond. Some of the debris slips down the ice front in a mudflow (FL). Meltwater runs through the ice in a crevasse (C). A superglacial stream (SS) drains the top of the ice, forming an outwash fan (OF). Moving ice has overridden an immobile part of the front on a shear plane (S). All but the top of a block of ice (B) is buried by outwash (O).

Sediment from the melted ice of the previous advance (figure 2) was left as a till layer (T), part of which forms the till plain (TP). A shallow, marshy lake (L) fills a low place in the plain. Although largely filled with drift, the valley (V) remained a low spot in the terrain. As soon as its ice cover melted, meltwater drained down the valley, cutting it deeper. Later, outwash partly refilled the valley--the outwash deposit is called a valley train (VT). Wind blows dust (DT) off the dry floodplain. The dust will form a loess deposit when it settles.



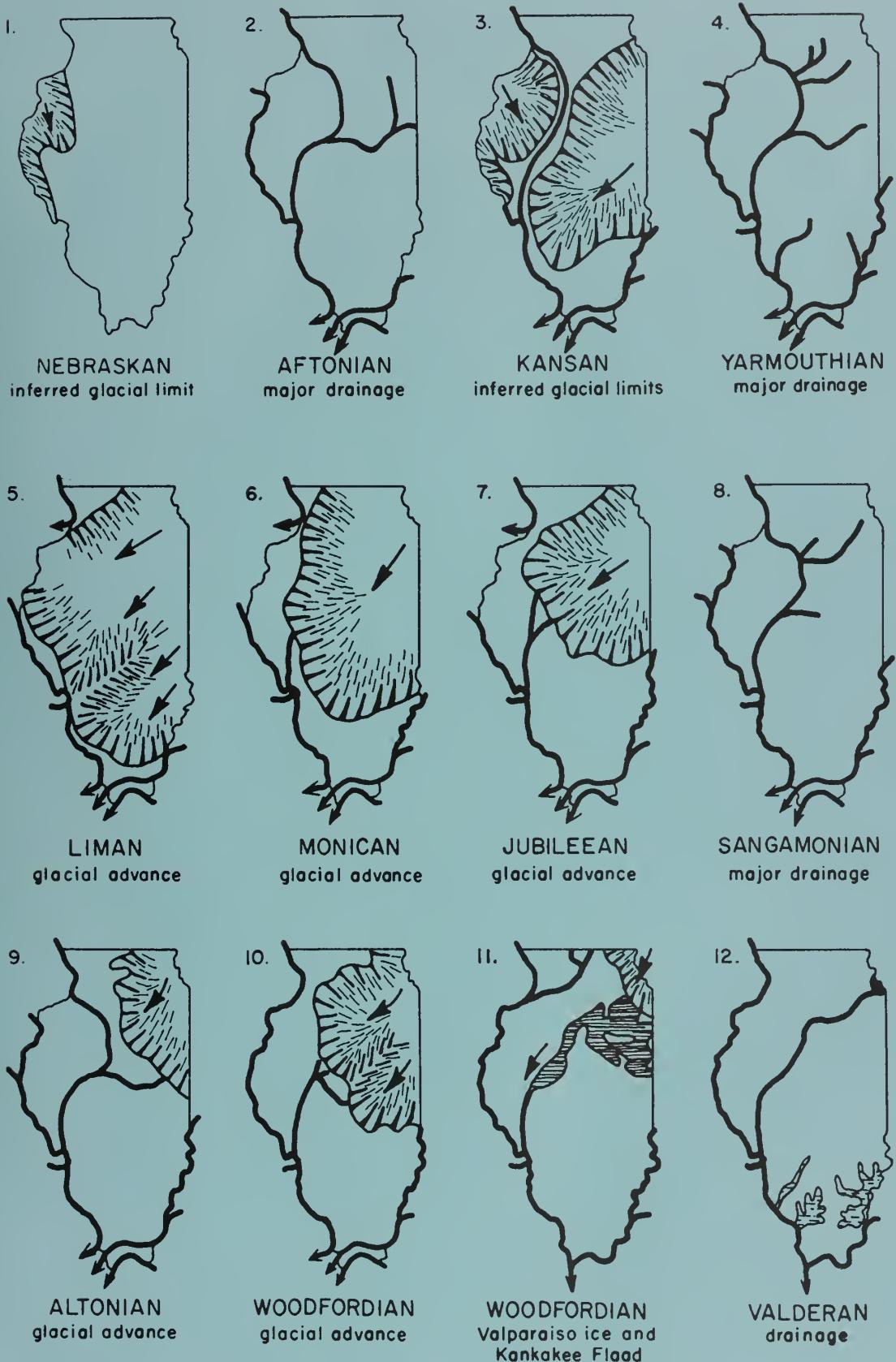
4. The Region after Glaciation - The climate has warmed even more, the whole ice sheet has melted, and the glaciation has ended. The end moraine (EM) is a low, broad ridge between the outwash plain (OP) and till plains (TP). Run-off from rains cuts stream valleys into its slopes. A stream goes through the end moraine along the channel cut by the meltwater that ran out of the crevasse in the glacier.

Slopewash and vegetation are filling the shallow lake. The collapse of outwash into the cavity left by the ice block's melting has made a kettle (K). The outwash that filled a tunnel draining under the glacier is preserved in an esker (E). The hill of outwash left where meltwater dumped sand and gravel into a crevasse or other depression in the glacier or at its edge is a kame (KM). A few feet of loess covers the entire area but cannot be shown at this scale.

TIME TABLE OF PLEISTOCENE GLACIATION

STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
HOLOCENE	Years	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	Before Present		
	7,000		
	Valderan	Outwash, lake deposits	Outwash along Mississippi Valley
	11,000		
	Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500		
WISCONSINAN (4th glacial)	Woodfordian	Drift, loess, dunes, lake deposits	Glaciation; building of many moraines as far south as Shelbyville; extensive valley trains, outwash plains, and lakes
	22,000		
	Farmdalian	Soil, silt, and peat	Ice withdrawal, weathering, and erosion
	28,000		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers
	75,000		
SANGAMONIAN (3rd interglacial)		Soil, mature profile of weathering	
	175,000		
ILLINOIAN (3rd glacial)	Jubileeann	Drift, loess	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
	Monican	Drift, loess	
	Liman	Drift, loess	
	300,000		
YARMOUPTHIAN (2nd interglacial)		Soil, mature profile of weathering	
	600,000		
KANSAN (2nd glacial)		Drift, loess	Glaciers from northeast and northwest covered much of state
	700,000		
AFTONIAN (1st interglacial)		Soil, mature profile of weathering	
	900,000		
NEBRASKAN (1st glacial)		Drift	Glaciers from northwest invaded western Illinois
	1,200,000 or more		

SEQUENCE OF GLACIATIONS AND INTERGLACIAL
DRAINAGE IN ILLINOIS

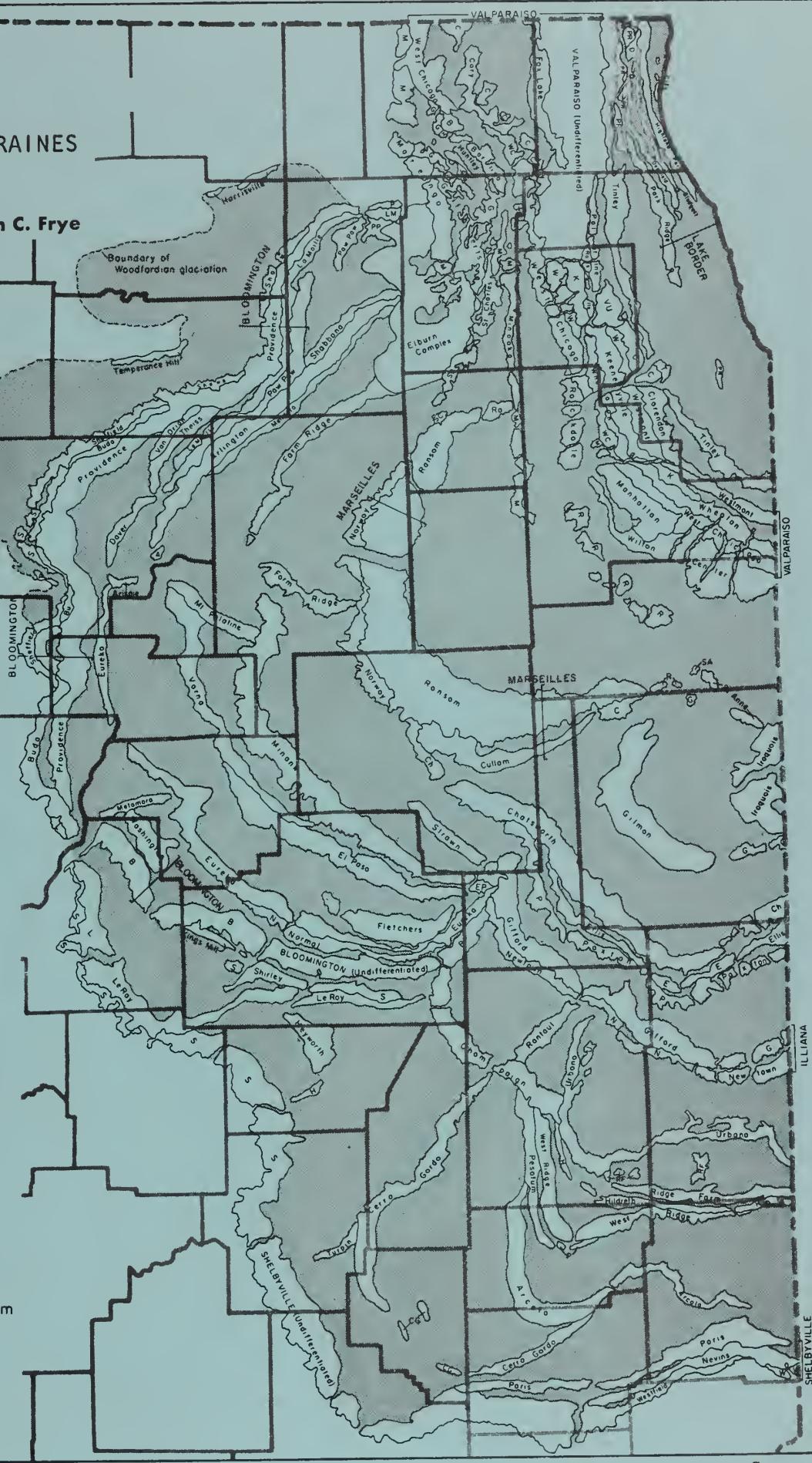


(From Willman and Frye, "Pleistocene Stratigraphy of Illinois," ISGS Bull. 94,
fig. 5, 1970.)

WOODFORDIAN MORAINES

H. B. Willman and John C. Frye

1970



GLACIAL MAP OF ILLINOIS

H.B. WILLMAN and JOHN C. FRYE

1970

Modified from maps by Leverett (1899),
Ekblaw (1959), Leighton and Brophy (1961),
Willman et al. (1967), and others

EXPLANATION

HOLOCENE AND WISCONSINAN

Alluvium, sand dunes,
and gravel terraces

WISCONSINAN

Lake deposits

WOODFORDIAN

Marine

Front of morainic system

Graundmaraine

ALTONIAN

Till plain

ILLINOIAN

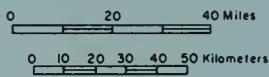
Moraine and ridged drift

Graundmaraine

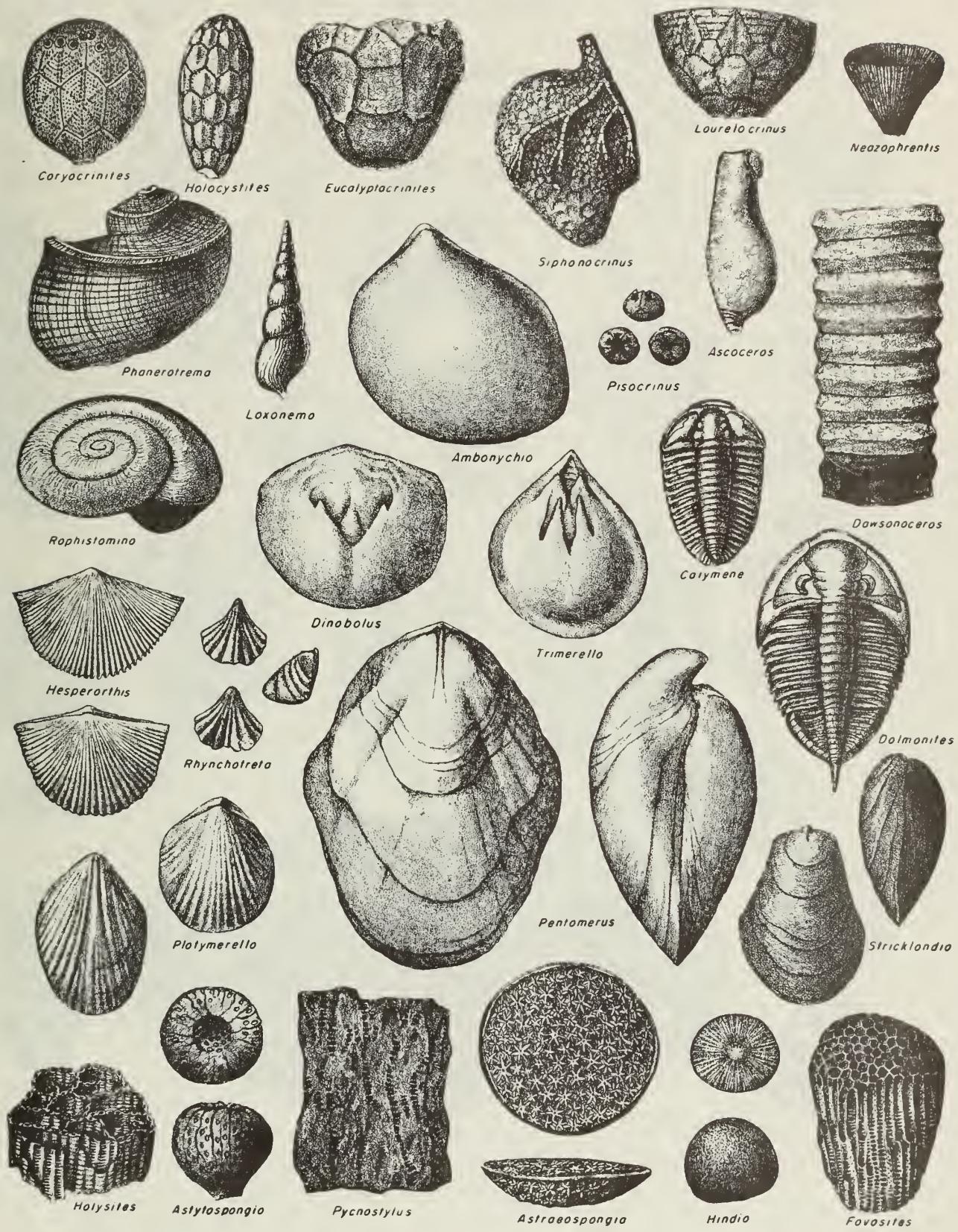
KANSAN

Till plain

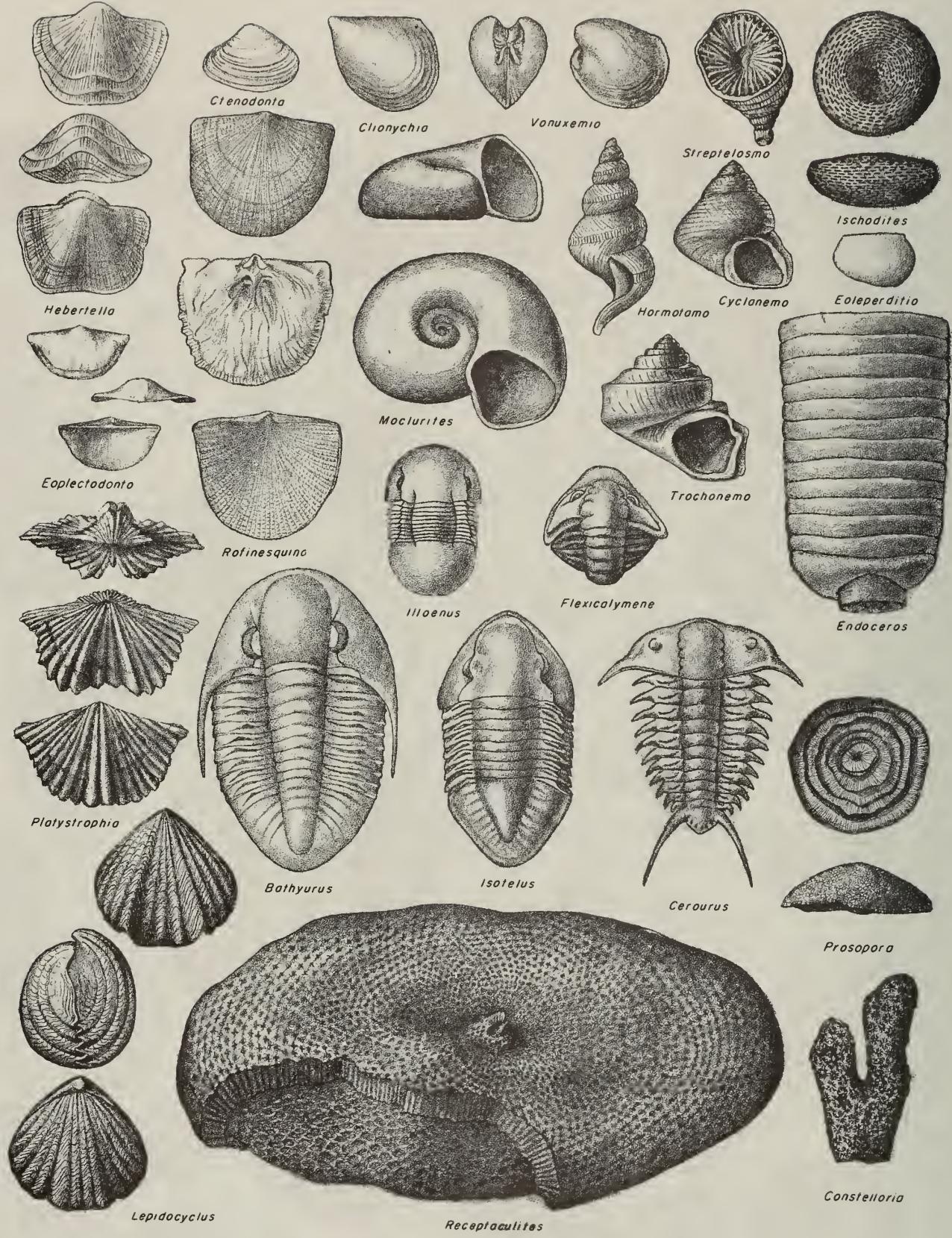
DRIFTLESS



REPRESENTATIVE SILURIAN FOSSILS FROM NORTHWESTERN ILLINOIS



ORDOVICIAN FOSSILS



Geology Survey

Site # 3/1 April

Second

~~Building without foundation~~

Championship Plateau

~~Rock~~

Trade back & forth

few hours

I get back in a

car go to file

